AMERICAN MACHINIST

August 20, 1941

Trainees—*The aircraft industry has expanded at a record-breaking rate. Bell Aircraft has met the need for more men with a well balanced training program*

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DIVIDEND CERTIFICATE

ISSUED TO *Every Reader of American Machinist*

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Special Section on The Working of Tool & Die Steels

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For Further Dividends, read every page of every issue of AMERICAN MACHINIST *even more carefully. Each is packed with information immediately useful to you in your business.*

WHAT'S IN THIS ISSUE

AUTOMATIC GAGING

For a long time manufacturers have been forced to employ men to perform the tedious and time-consuming job of inspecting parts for accuracy. Many a production man has wished for the day when the task could be done automatically. At the Ford Motor Company that day has arrived; their engineers have developed an automatic process which holds close dimensional limits on parts produced in large quantities. Herbert Chase, whose articles have appeared in AMERICAN MACHINIST many times before, describes the operation and application of this new method of gaging. His article, "Machine-Made Inspection," begins on page 793.

A TRAINING FEAT

"For the first time in many years labor has a seller's market." That statement has been repeated so often it has become an old saw in a relatively short time. However, only a few companies have been able to rise above the situation, find a way to increase their working forces in number and effectiveness in the face of great demands for speeded production. Bell Aircraft, which increased its force from 1,500 to 7,500 in a year, is one of these. The company pulled hundreds of students from vocational schools, NYA centers, and private schools to its plants. It upgraded hundreds more of its own employees, emphasized safety and efficient instruction. George B. Fuller, Bell Aircraft's director of training, tells how the entire job was done in "New Craftsmen at Bell Aircraft." Turn to page 797.

G. W. JOHNSON *at work*

MACHINING METER FRAMES

The conventional approach to this problem not only requires some 77 operations with drills, counterbores, etc., but generally results in a lack of uniformity. Then, too, after the first series of operations, the product is put into other machines and further work is done often resulting in greater error. G. W. Johnson, tool drafting section, General Electric Company, knows how to eliminate the undesirable conditions under which this work is performed. His answer is a multiple-station straight-line unit for machining meter frames. See page 800.

SHELL PRODUCTION

Only two months after International Harvester had signed a government contract to make 75-mm. shell, the Milwaukee Works began forging operations. The fast start was due to efficient planning, effective use of machines already on hand. The complete production story—from steel bars and forgings through the turning operations to the final shell—is told in "Standard Machines for Shell Production." See page 807.

MORE ON WORK CLAMPS

"There are always a number of ways in which a given part may be located and clamped in a jig or fixture," says John G. Jergens, Cleveland Pneumatic Tool Company, in part II of his article, "Work Clamping Devices." Twenty illustrations help describe many of the methods which have been successful. Turn to page 802.

FINISHES—MOTION ECONOMY

This time our reference book sheet contains two features instead of the usual one. First, the more frequent troubles encountered in paint finishing may be overcome in simple manipulations and changes. John Sasso, of *Product Engineering*, tells you how it's done on page 823. Secondly, although few shops have directly applied motion studies for setting operation time values, many can benefit by applying the principles of motion economy. J. J. Phillips contributes the "know-how" in his comments on page 825.

IRREPRESSIBLE FLAME HARDENING

Beginning on page 804 is this issue's installment of an interesting series of articles on Oxyacetylene Flame Hardening written by J. G. Magrath, applied engineering division, Air Reduction Company. If you have read any of the previous parts in this group, you know how really useful this material is. See page 804 for the applications to "Cast Steel and Iron."

GEORGE B. FULLER, *director of training, explains a milling machine*

COMING

Because aircraft guns are inaccessible during flight, and because some planes use synchronized fire (if hang fire occurs the propeller blades may be damaged), some special problems exist in the manufacture of machine gun ammunition. The Armament Section of the next issue will tell the story of the production of cartridge cases, jackets, point and core for armor piercing cartridges at Frankford Arsenal. Also scheduled for an early issue is a timely story on the selection of men for defense industries. The article tells you how to apply aptitude tests so that you may be better able to select men for your shop.

CINCINNATI HYPRO PLANER

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CINCINNATI Planers are not only ideally suited to present defense production but are flexible enough to meet the needs of future requirements. Forged steel herringbone rack . . . side weights inside housings . . . extended saddle for harp support . . . forced feed lubrication to vees, guides, gear train and bearings . . . selective dial feed and rapid power traverse to all heads are a few of the construction points that maintain accuracy and facilitate operation for speeding up defense work.

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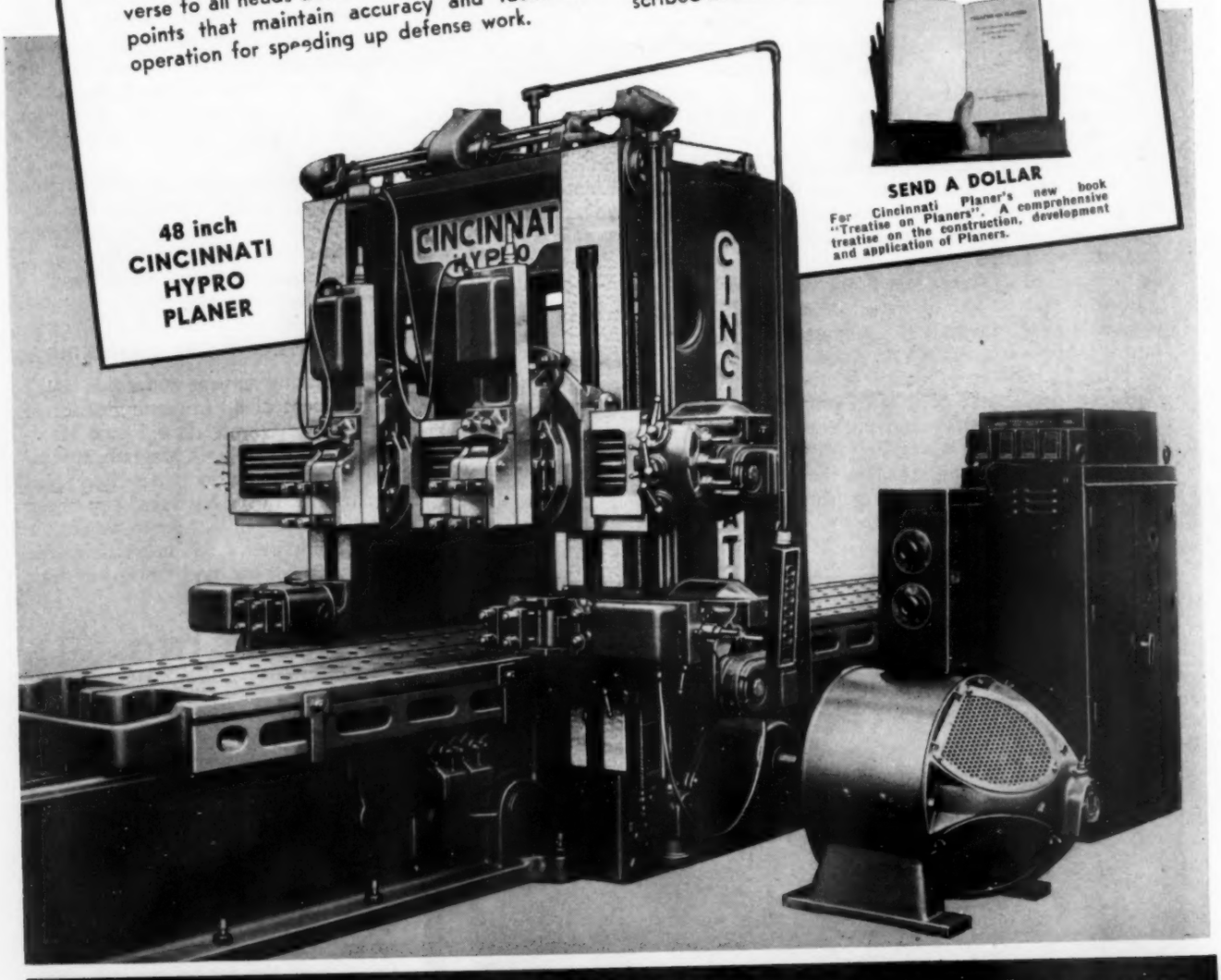


THE CINCINNATI PLANER COMPANY

CINCINNATI . . . OHIO . . . U. S. A.

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

Machine-Made Inspection

BY HERBERT CHASE

Here is the loading end of a gaging machine which checks no less than 15,000 dimensions on 300 automobile crankshafts in one hour

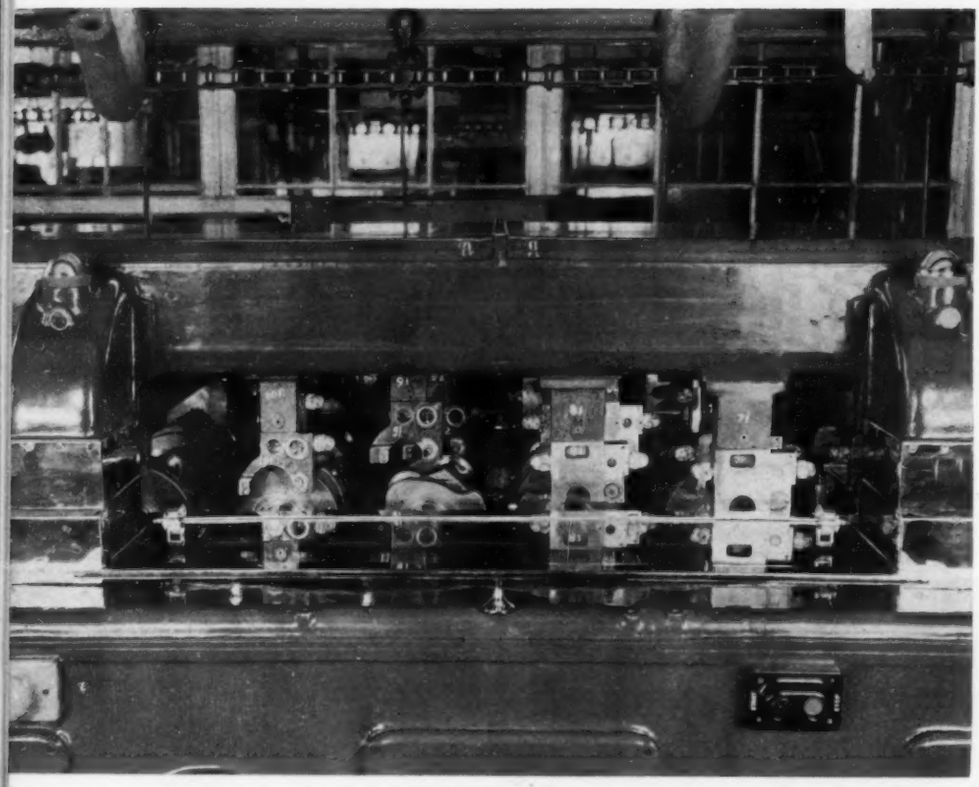
When there are large quantities of small parts to be made, gaging is a time-consuming job. Ford's solution is to gage automatically

THE FORD MOTOR COMPANY has developed an automatic method of holding close dimensional limits on parts produced in large quantities; the maintenance of these limits involves the use of gages of high precision. In uncounted cases, 100 percent inspection is required, often involving the use of "go" and "not-go" gages. The greater the number of precision parts and the greater the number of dimensions on these parts which require gaging, the more important it becomes to gage by automatic means. It is imperative also that gaging be completed as quickly as conditions permit; otherwise, a large number of rejects may be produced before the cause of rejection can be remedied.

Of all the machines developed for automatic gaging, that used on crankshafts for eight-cylinder V-type engines is the largest and most complex. Except for loading and unloading, the machine is completely automatic. It is arranged to handle 300 crankshafts an hour and to check by gaging no less than 50 dimensions on each crankshaft which passes through it. Gaging is done at ten separate stations in the machine; hence there is an average of five gages per station. At most of the stations the crankshaft comes to rest, but where it is necessary to rotate it in order to detect eccentricity, provision for such rotation is made and takes place automatically.

Accuracy in gaging is, in one sense, indepenent of the machine. This is because all gages are flexibly mounted in such a way that gage supports come to rest on certain surfaces of the shaft itself; these surfaces are reference points from which gaging the individual dimensions is done. It is unnecessary to build the machine with extreme precision or to maintain correct gaging points or surfaces on the machine itself.

Although many of the dimensions are held within limits as close as 0.0002 in.,



A side view of the crankshaft machine shows the gages lifted out of contact with the work. Surfaces outside the prescribed limits are automatically marked with ink

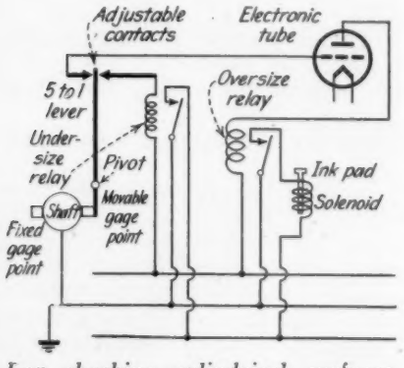
The camshaft gaging machine inspects 600 pieces per hour and separates non-standard shafts from those within the allowed limits

the critical surfaces are not those on the machine parts but those on the crankshafts being gaged. The machine merely advances the shafts, stops (or drives) them at each successive station and, when the shafts are in correct position, lowers the gages so that they will check the proper dimensions. Another function of the machine is to apply, by means of ink pads, distinguishing marks that enable the operator to determine which, if any, of the dimensions are outside the limits specified. This identification is accomplished by electrical or electronic means, the objective being to raise the ink pad and mark the shaft (through a solenoid mechanism) when the dimension is outside required limits.

Gages Controlled Electrically

The gaging itself is done in each case between one fixed point and one movable point with the latter on the shorter arm of a five-to-one lever. At the end of the long arm there is an insulated contact located in a gap between a pair of mating contacts which are adjustable by means of screws with accurately made treads. If the dimension is above the limit set, the insulated contact on the long lever is thrown against one fixed contact closing a relay which in turn actuates a solenoid and raises the ink pad to make a mark on the shaft at the correct point. If, on the other hand, the dimension is below the limit, the circuit is closed through the other fixed contact, actuating another relay and solenoid.

Contacts are made of polished tungsten and are arranged for ready adjustment. If no contact is made in gaging, the dimension is between the required limits, and no telltale mark is made. The circuit is so arranged that, in addition to making a mark on the shaft, it warns the machine operator by a light and buzzer when the shaft reaches the unloading end of the machine. The shaft then can be rerouted through a



For checking cylindrical surfaces, relays and an electronic tube are connected to the gaging points as illustrated

salvaging department where, if possible, the dimension is corrected, or if it is undersize, the shaft is scrapped.

At stations where the gaging requires that the shaft be rotated, it has been found necessary to use relays which are operated through electronic tubes because the time of the electrical contact may be too short to permit a telephone relay to operate as desired. The electronic circuit, being much more sensitive, insures operation of the relay and corresponding solenoid even for an extremely short closing of the gaging contact. An accompanying schematic diagram shows how the contacts are arranged and the electrical circuit employed.

Quite aside from the gaging itself but properly timed with it, is the mechanism for advancing the shafts through the machine and stopping them in correct position at the successive gaging stations. Basically, the machine involves a pair of continuous chains which pass over sprockets at each end. On the chains at fixed intervals are carriers equipped with idler rollers on which the shafts are placed when the machine is loaded. The driving sprockets are actuated by a Geneva movement so arranged that the sprockets turn through 90 deg. and then come to rest for 270 deg. during which latter period the gages are lowered and again raised by a cam driven in timed relation with the sprockets. All the gages are supported on a common carrier or frame, and every time the frame is lowered each of the 50 gages function. When the frame is lifted, the shafts are advanced one station. During the transfer, the shafts are rotated a given number of degrees to bring them into position for the next gaging and, as already indicated, means for rotating the shaft slowly are provided at two of the ten stations.

Interconnected Safety Devices

Interconnected with the driving mechanism of the machine are various safety devices. One of these operates at the loading end and brings the machine to a standstill unless and until a shaft is properly placed in the loading position. Similarly, if the operator at the discharge end does not unload a shaft which has reached the unloading position, the machine will not start again until this shaft is removed. Along the bed of the machine, which is inclosed under glass inspection windows, there are switches so placed that the machine stops whenever any one of these windows is opened. Normally the machine operates continuously so as to handle the gaging of 300 shafts an hour. Operators take shafts to be inspected from a chain conveyor as they come by the loading station and hang them on a

A pivoted chute guides under- and oversize valve-seat inserts into separate containers and bounces those correct in size on an anvil to determine their soundness. Acceptable ones bounce into the container

This machine tests valve tappets for hardness, sorts them for size and discards those that are not passable. Note the scleroscope and electronic tube set-up at the right.

similar conveyor after they have been through the machine and the gaging has been completed.

Camshafts are gaged automatically in a similar machine but one having fewer stations, as there are only 25 dimensions which require gaging. Since the parts are lighter, they can be handled at twice the speed of crankshafts, namely, at the rate of 600 an hour; hence the total number of gagings per hour is the same as on 300 crankshafts. In the camshaft gaging machine there is an automatic device to discharge shafts which do not pass inspection at a different level than those which do pass. Defective dimensions are marked by ink pads which are actuated the same way as in the crankshaft machine described above.

Automatic gaging is not confined to large parts such as crankshafts and camshafts. It is used on such parts as piston pins, valve tappets and valve seat rings. Besides dimensional gaging, some of these parts are automatically checked for hardness and for flaws; in addition they are sorted into sizes varying as little as 0.0001 in.

Ring-shaped valve-seat inserts are first loaded into a hopper from which they are fed automatically by a rocker arm into a track or channel which slopes downward. There the rings enter the machine proper and are automatically gaged for thickness and for outside diameter. Those undersize in either dimension are discharged through one chute and are scrapped. Those which are oversize in either dimension are discharged through another chute and are returned to have excess metal removed. Those which come within required dimensional limits are dropped on an anvil and, if free of flaws, bounce into a container. If any of the rings are cracked, they do not bounce high enough to reach the container and thus are separated from the sound rings and scrapped. The device which does the sorting is an inclined chute arranged to swing about a pivot under the influence of solenoids which are in turn actuated by relays whose functioning is determined by contacts forming parts of the gaging device. The machine has a capacity of about 4200 valve seats an hour.

Piston pins are sorted into three sizes for selective assembly and into over- and undersize compartments. Tests for hardness, straightness and smoothness are included in this machine

Another machine is designed to advance valve tappets in vertical position from the loading end to the first station, where a scleroscope is used in combination with a photo-electric cell to make sure that hardness is up to the required number. If the scleroscope hammer on striking the end of the tappet, rebounds to the required height, a beam of light which strikes the cell is interrupted. The electrical hook-up is such that the other tappets, which are too soft, are ejected into a scrap bin through a gate which is tapped automatically. The gate remains shut for pieces hard enough to pass inspection, and they are advanced to the next station in a horizontal position and proceed in an intermittent motion along a horizontal track.

The parts come to rest successively in each gaging station through which they pass, but parts which are under- or oversize in various dimensions are thrown out automatically. At the same time they are sorted into boxes depending upon which dimension is off size and whether it is above or below the limit specified.

Parts which are oversize are returned to machines which remove the excess metal after which they are again gaged. Those which are undersize are rejected and scrapped. At stations on the tappet gaging machine where the part is caused to rotate during the gaging (for checking out-of-roundness), electronic devices are used in addition to relays to provide the extra sensitivity required.

For gaging piston pins, the machine used is similar to that for valve tappets, but sorting is done at the discharge end rather than at the respective stations. On this machine, checks are made for hardness, straightness, smoothness and roundness; gaging is done so the pins are sorted into three acceptable size groups or are thrown out because they are above or below the permissible range. Sorting is done by swinging a small chute, or funnel, which receives the piece as it is discharged at the end of the machine. The position of this chute is set in advance, for each pin by magnetic means through solenoid actuated by the gages which determine the sorting size. If the piece is too large to pass inspection, the hopper moves to one extreme position, and if too small, to the opposite extreme. Between these two positions are three others for pieces of each of the three acceptable sizes. At each position a flexible tube guides the pin into one of the five bins provided. An operator removes the pins from these bins, placing the acceptable sizes in corresponding tote boxes for transfer to selective assembly stations. Oversize pins are returned for further machining, and those which are under required limits are scrapped. Four thousand pieces an hour are gaged.

Although all these machines differ in details to adapt them to parts of various sizes and shapes, they make use of similar gages with contacts arranged to sort or otherwise indicate divergence from the required size. All gaging is done with reference points on the piece itself and with the gage so supported that it accommodates itself to the work and is not dependent for accuracy upon parts of the machine independent of the gaging unit. Gaging is rapid and dependable, and results in great savings in time and labor as compared with ordinary hand gaging operations.

New Craftsmen at Bell Aircraft

BY GEORGE B. FULLER
BELL AIRCRAFT CORPORATION

An instructor at the Corporation's Buffalo plant checks the riveting work of a trainee

With the supply of skilled craftsmen at almost nothing Bell Aircraft had to increase its working force from 1,500 to more than 7,500 men a year. Here's how

ONE OF THE most important tasks faced by the management of Bell Aircraft Corporation in the spring of 1940 was the expansion of its family of workers from something less than 1,500 in number to more than 7,500, within a twelve-month period. By spring of last year, there was no longer a reservoir of skilled craftsmen, whose years of training fitted them for the close-tolerance work needed by the aircraft industry.

Something had to be done, fast and efficiently. If no supply of skilled manpower existed, then we'd have to train our own workmen. If we could design our own machinery to build airplane parts, and we had done just that, then perhaps we might also succeed in building thousands of workers.

It did not take us long to discover that we had most friendly and powerful allies in our venture. Outstanding among these were the public vocational high schools operating national defense courses throughout New York State, and National Youth Administration training projects. Young men coming from these courses, together with smaller numbers from accredited, privately operated schools, provided the "raw stock" requiring further "polishing" before we could staff our assembly lines and machine shops.

Briefly, the public vocational school courses consisted of 400 hours of instruction, spread over a 10-week period. Because of regular school during the day and supplementary training courses during the evenings, these defense training courses have been conducted as a third-shift operation, with instructors and students working from before midnight until breakfast time. To date, a large portion of our new employees have come from the Burgard Vocational School in Buffalo, and we are most grateful to this institution for its splendid cooperation. However, we have gladly employed graduates of similar courses from other schools.

Bell Aircraft's job begins when young men by the hundred are hired weekly from such preliminary training programs. Our employment office, under the supervision of Vaughn Bell, exercises the greatest care in studying the individual merits of the applicants.

Once accepted by Bell Aircraft, new employees are given intensive training to fit them for a specific type of work. This program has as its goal the teaching of men to become semi-skilled workers. From a minimum of one week this training extends to a maximum of four weeks. No effort is made to turn out master mechanics at such a rate; we are under no illusions about the amount of training which can be absorbed in so short a period.

As soon as they have passed their physical examinations, the recruits are given an intensive induction into the Bell Aircraft family. Perhaps the emphasis we place on this type of welcome is greater than elsewhere, but we have found it completely worth while. Company policies; value of first aid and safety precautions; company rules and regulations; and opportunities for participation in insurance hospitalization and credit union programs are all discussed.

A highlight in the induction is the

introductory talk by Vaughn Bell, who heads up all industrial relations work carried on at Bell Aircraft. Speaking simply, almost humbly, Mr. Bell makes the recruits feel they have become valued members of the Bell Aircraft family. In terms which all can understand, he explains the responsibility borne by all to achieve maximum efficiency in the successful prosecution of the national defense drive; he tells the basic reasons for the pride which all Bell Aircraft employees have in the fighter planes they have helped to build. His explanation of the strict rules and regulations set up makes them appear in their true light as reasonable precautions for the protection of employee as well as the management and, over all, the government. Vaughn Bell is a firm believer in the "little things". When he has finished speaking, the recruits are no longer new employees; they have become an integral part of Bell Aircraft.

Further, Vaughn Bell emphasizes the fact that in an industry growing so fast as aircraft manufacturing, opportunities for self-advancement are great. New foremen, new leadmen are always needed. Promotions come to those who earn them and the Bell Aircraft management is always eager to give a man his chance to climb upward.

The talk of William Nicholas is also important in this induction period. Mr. Nicholas, head of our First Aid department, stresses the common sense behind health protection measures adopted by Bell Aircraft. Only by maintaining health can the employee be true to himself and his company in maintaining unbroken and efficient production. That is why Bell Aircraft's plants are kept so clean, and why the emphasis always is placed upon prompt medical attention for even the slightest scratch or bruise. In this regard Mr. Nicholas particularly cautions new employees about eye injuries. Eye shields and goggles are furnished for all work where dust from grinders or chips from drilling or routing might present a hazard. The First Aid department keeps busy washing out tiny particles from workers' eyes before more elaborate treatment becomes necessary.

From James H. Hucker, safety engineer, new employees learn more about work being done by Bell Aircraft management to assure safe and efficient operation of the factory and assembly lines. He tells them about the newness of equipment—most machinery is less than two years old—and of the numerous guards installed to protect workmen. Where desirable, safety shoes are required; the entire Bell Aircraft organization is permeated by an awareness of the necessity for safety. Because so many of the new employees hired by Bell Aircraft have never worked in an industrial organization before, the detail with which this subject is treated is fully justified.

Trainee and instructor work side by side at Bell Aircraft Corporation's Buffalo and Niagara Falls plants as riveting technique is being taught

George B. Fuller, director of training, and Leonard J. Kline, assistant director of training, outline the rules and regulations applicable to Bell Aircraft employees. They also tell of the insurance and hospitalization benefit opportunities, and the Federal Credit Union which is organized and operated by company employees. Trainees who come to Bell Aircraft often lack the minimum kit of equipment with which to begin work. In such instances arrangements are made for purchase-loans, amounting to about $30, through the Credit Union.

All trainees wear blue caps on which their classification is indicated. A special factory pass button, larger than those worn by seasoned employees, is worn by each trainee who works a regular day shift of eight hours, five days a week. They are not assigned to the second or third shifts, nor are they permitted to work overtime. In so far as possible, they are given work for which they have shown the greatest aptitude. Individual preferences are considered whenever consistent with good operation.

Success of the Bell Aircraft employee training system depends in a large measure upon the working instructors, who are specially chosen for their ability to impart, within a minimum period of time, a measure of their own skill. At Bell Aircraft, there are 384 jobs in the shop, but instruction is divided into four broad classifications: riveting, assembly, fabrication and machine shop.

Instructors are divided into two classes: working and supervising. The former group consists of men selected for their craftsmanship plus their ability to tell or teach operations of their work to the trainees. Experienced and highly skilled men only are chosen for this work. They are men who take pride in their work and have excellent "work habits". The patience and painstaking care with which they guide the green employees is among the most gratifying aspects of the entire training program.

Supervising instructors also are men with years of practical shop experience and proven skill. Many of these supervisors have had experience in other departments of the shop, and this added knowledge enables them to make wise recommendations whenever a trainee seems better fitted for another type of work than that for which he is being trained. Each supervising instructor has from twelve to fifteen trainees under his care.

In the machine shop, trainees work with experienced machinists, at the various types of equipment. As soon as the trainee has familiarized himself with the type of operation performed he is given a thorough explanation of the manner in which the machine does its job. The machine will be operated so slowly that the work it accomplishes

will be readily understandable. During this period, the instructor explains each segment of the complete operation after which the trainee is allowed to try his hand at doing the work. At all times safety and the truth that haste makes waste is stressed.

Emphasis is placed upon the importance of mastering "key points" in the performance of a machine tool operation. Such production aids as "knacks," special motion, particular timing or particular ideas, which when mastered enable the operator to do his job quickly, safely, and without wastage.

As this instruction work continues, the trainee is encouraged to perform more and more of the operation, until at last he is running the machine, with the insuructor serving only as an observer. Not until the instructor is convinced that the trainee is fully competent, however, will he be placed on his own.

Trainees assigned to riveting are checked on the use of the "gun" and are shown how to adjust air pressure to get the proper force in their hammer. The Bell Aircraft method of riveting is necessarily exacting, because so much of the riveting work done by the company is of the flush type. When the fundamental operations are correctly taught, the trainees soon master the proper technique.

Before he has completed his course, the trainee has learned how to buck rivets, using various shaped bucking bars, and has become adept in the art of upsetting rivets so they will produce a tight joint and pass government inspection. He has been taught dimpling and countersinking. He knows how to spot an unsatisfactory rivet whether the defect be too long a shank, off-center setting, or incorrect size. He is now ready to begin the more simple operations on the production line.

Training for the job of assemblyman continues at Bell Aircraft in such fashion as to make the most of the skill the recruit has gained from his vocational school course. But at the factory he is put on production work and is constantly tutored in the technique of using all assembly tools properly. For example, the necessity of always using a drill stop and of knowing that there is no hidden part which the drill might injure.

Other phases covered by the instruction include maintenance of the proper edge distance; use of the proper size drill for different diameters of rivets, bolts and screws; use of Cleco fasteners; danger of chips lodging between parts to be bolted or riveted, and other items of assembly technique. In this division, as with the others, the skilled work instructor is the man who teaches the trainee about production.

Due to the scores of types of assembly work required in the mass production of a fast fighter airplane, Bell Aircraft does not expect that a trainee will be able to become a master craftsman in all the branches of assembly work. But he is expected to become an acceptable workman at the specific stations to which he probably will be assigned. Later, as his skills increase, he may be shifted to other operations.

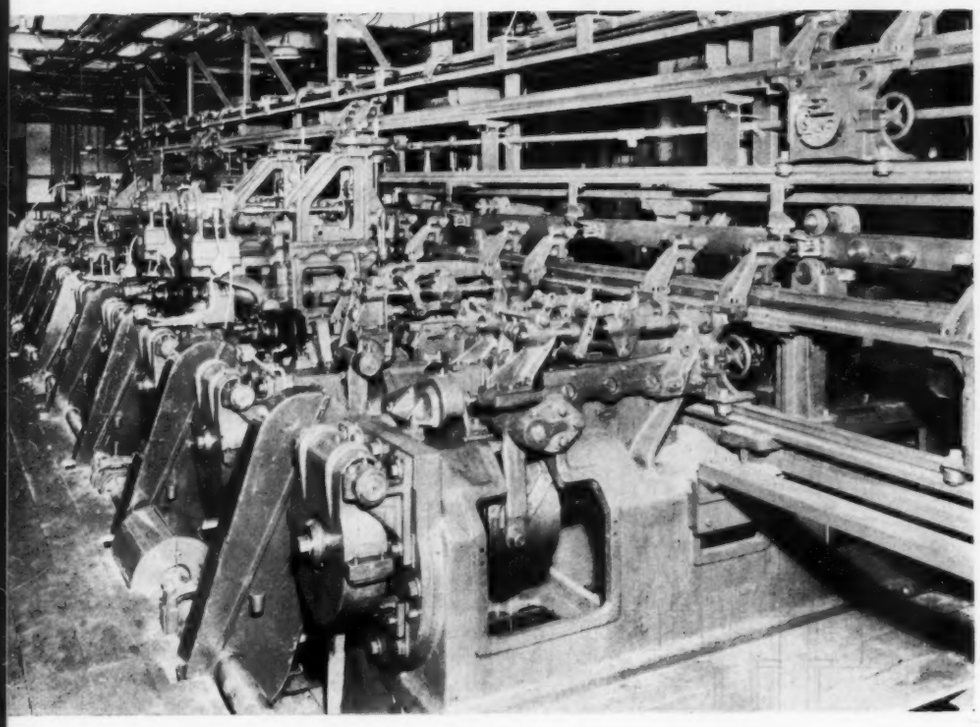
In the assembly section of the factory, the value of accuracy is repeatedly emphasized. At this stage in the manufacture of an airplane, hours of previous production work can be wasted because of careless work, resulting in spoilage of parts. Not only is expense involved when such rejections result but production is delayed.

Trainees coming to Bell Aircraft with elemental instruction in fabrication work are first assigned to the work of burring plates and parts and thus learn the use of file and scraper. After a day or two at this work, he usually becomes a helper on the shear cutter and then is given instruction as a helper on the stack drill or router. As soon as he has become proficient in this work, the trainee is given a machine to operate. He has learned how to set up a "stack" for drilling and is acquainted with the Bell Aircraft system of using templates.

To become a thoroughly competent man in fabrication work, the trainee must also have experience on the hydro press and drop hammer and at the bench. Bench work includes reforming such parts as have come off other machines, but are not true to form. Stretching and shrinking metal, as well as removing kinks, must be mastered. It requires three or four weeks of this familiarization work for the trainee to become a semi-skilled operator. The process of further improvement is in large measure up to the individual.

Patience and understanding, in large amounts, are necessary for the successful operation of an employee training program as in operation at Bell Aircraft. First, the trainee is taught his job, then he is impressed with the need for accuracy. Only after these two goals have been won is speed mentioned. Today, as the defense needs of the United States are magnified, accuracy without speed is not enough. But until accuracy has been accomplished, speed cannot successfully be sought.

Proper use of the file may seem an easy operation to learn: it isn't! A group of Bell Aircraft Corporation trainees learn by doing as a group instructor provides patient supervision



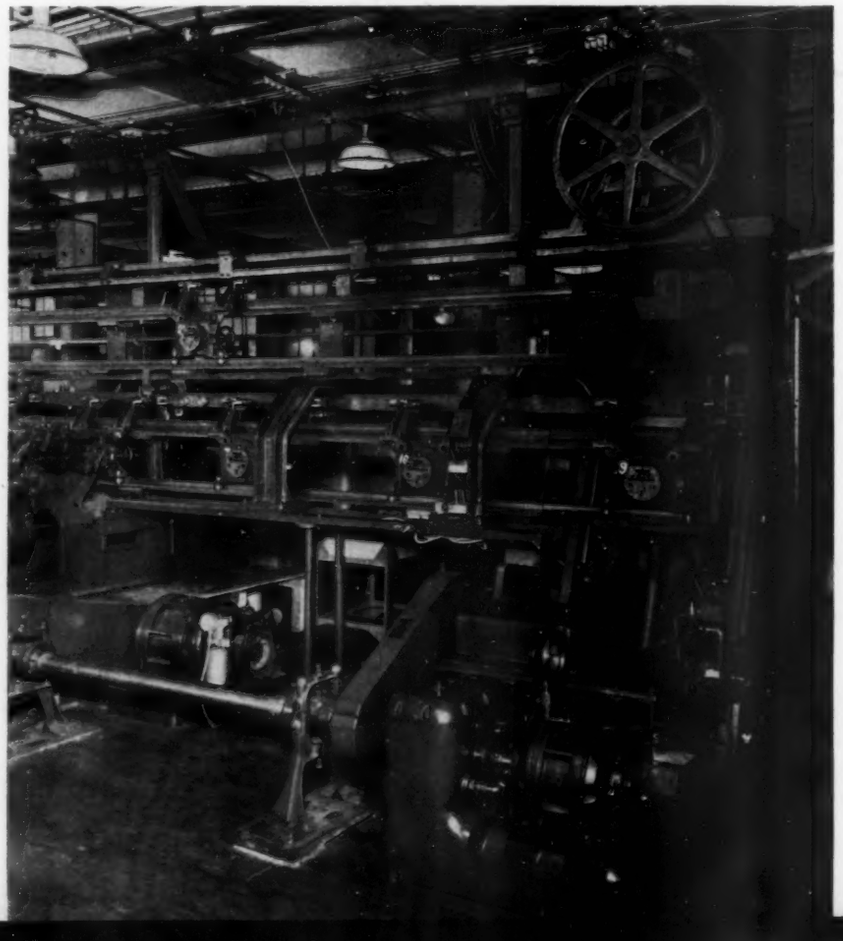
The eleven machining stations on this straight-line unit for operations on meter frames are spaced at 4-ft. intervals along the 65-ft. transfer mechanism. After each 15 sec. machining cycle the jigs supported by the lower rails are moved hydraulically to the next station in line. Drive to the cutting tools is mechanical; each head is fed by a drum-type cam

Automatic Machine for Meter Frames

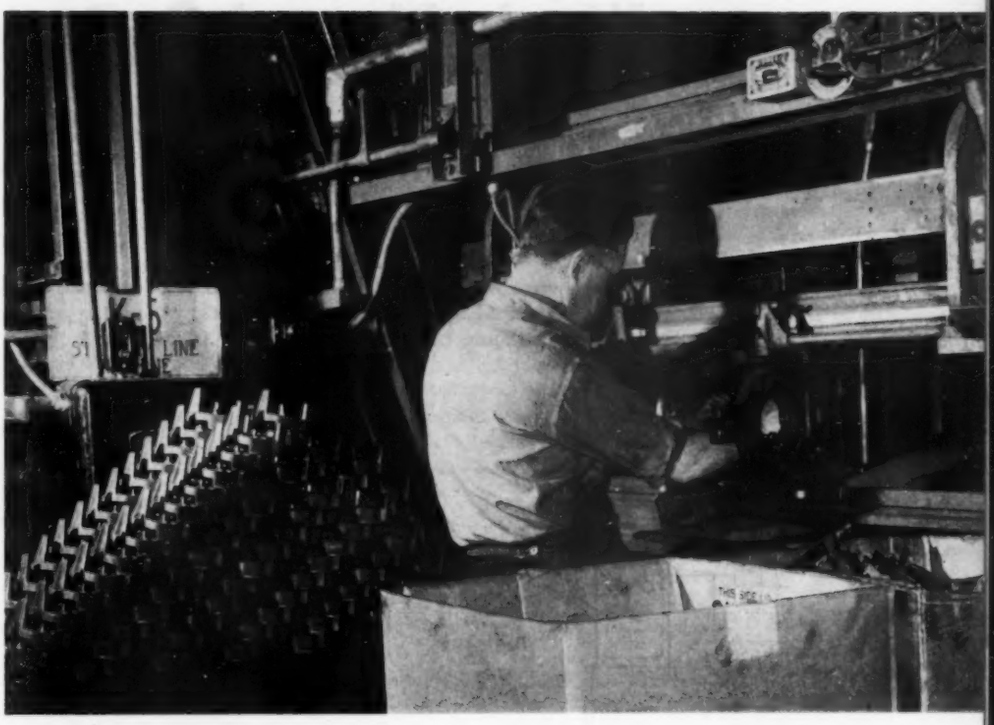
BY G. W. JOHNSON, MACHINE DESIGN SECTION, GENERAL ELECTRIC COMPANY

MACHINING the cast-iron frame for the General Electric Type I-30 watt-hour meter requires 77 separate operations by drills, counterbores, taps, side milling cutters and end mills. The drills, counterbores and taps are required to operate from five directions, and the milling is done from two opposite sides. Trouble-free conveyor assembly of these meters requires that the frames be uniform and accurate.

The conventional approach to the problem of machining this frame is to secure the part in a jig, locating from points upon the rough casting, and in a rotary indexing type machine perform all operations possible. Then in other machines of similar type, locating upon finished surfaces created in the earlier operations, gain access to further sur-



This view shows the hydraulic lift and jig-transfer mechanism in front of the loading station. Each jig is mounted in a hanger which supports it on the rails of the transfer mechanism



Loading and unloading are both done at the rear of Station No. 1. This operation is performed easily within the 15 sec. time before the jig moves away from the station. A second operator takes care of tool adjustment and replacement at the eleven machining stations

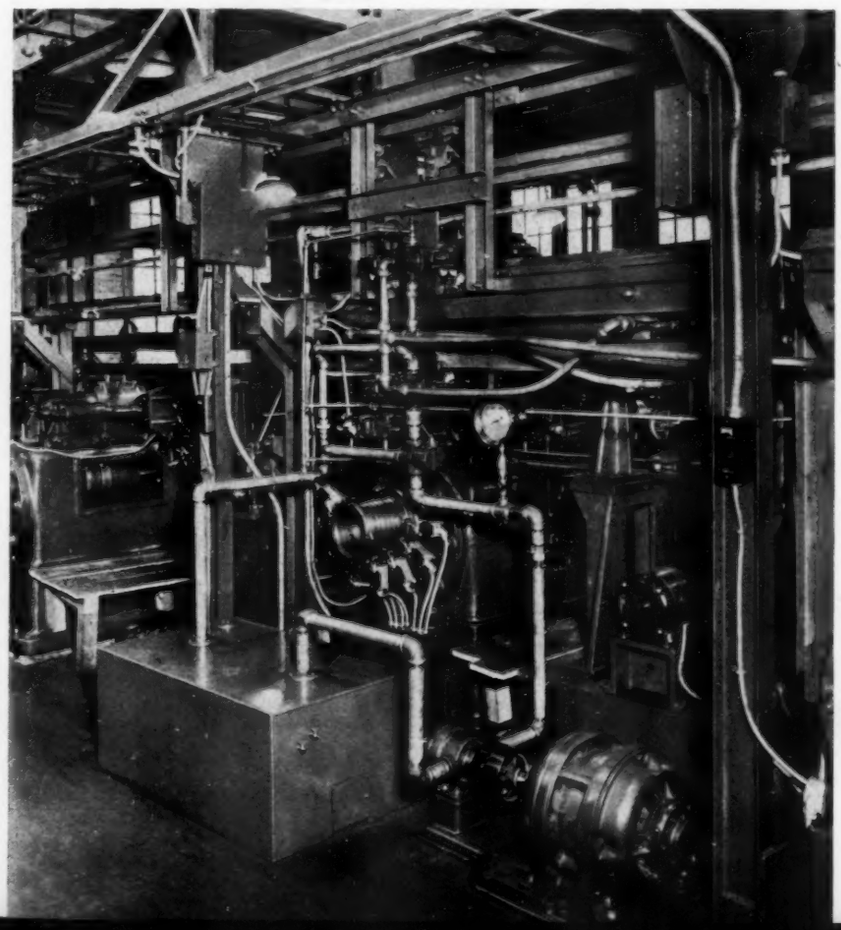
faces and eventually complete all operations. The most serious difficulty with this approach is that of obtaining satisfactory uniformity. While modern toolmaking accuracy is good, there always is something less than absolute uniformity in the eight or more jigs used in any one machine.

The product then of the first series of operations is not completely uniform and in subsequent machines, locating upon finished surfaces which lack complete uniformity, further work is done which lacks uniformity. The result is a large number of possible combinations leading to a final result which can increase, by three times, the magnitude of any single inaccuracy.

Another inherent limitation of a circular indexing machine is the fact that after selecting a certain number of divisions for the index, and the use of as many stations and jigs, it becomes impractical to change the number of stations. As changes in the design of the frame are desirable from time to time, there occurs a major problem of finding facilities for the additional operations.

For work of this nature the desirable condition is one where the part is held in one position only with all operations being performed without removing the piece from the locating jig or fixture. A straight-line, multiple-station unit which satisfies this condition has been built for machining these meter frames. In this machine eleven machining stations are placed in line facing a two-level transfer mechanism which moves the jigs on rails from the loading station successively in front of each machining station until they reach the other end of the unit. Then each jig is raised to an upper level and returned on rails by means of a roller chain to a lift at the loading end where the jig is returned to the lower level, so that the operator can remove the finished part and reload with a rough casting.

The drive of the cutting tools is mechanical, but the transfers, being intermittent and at comparatively high speeds, are operated hydraulically. In order that the hydraulic transfers may synchronize with the movement of the cutting tools, a master control station operates limit switches, which in turn control solenoid valves. One operator is required to load and unload the jigs. Another man is regularly assigned to the machine to attend to tool adjustment and replacement. The tool man keeps in close touch with the inspector and has general responsibility for the continuity of operation of the machine. Stations are spaced at 4 ft. intervals and additions or subtractions can be made without great difficulty.

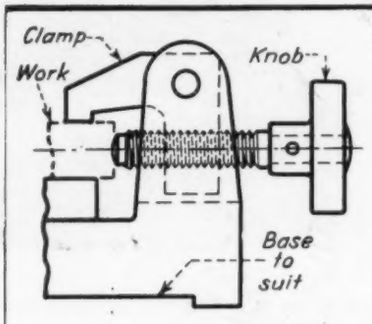


This master control station operates limit switches controlling solenoid valves for the hydraulic transfer mechanisms. The controls are interlocked so that the jigs can be moved from station to station only when the cutting heads have been returned to their starting positions

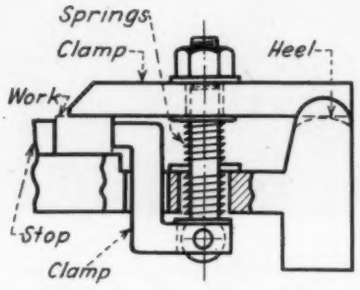
Work Clamping Devices—II

BY JOHN G. JERGENS, CLEVELAND PNEUMATIC TOOL COMPANY

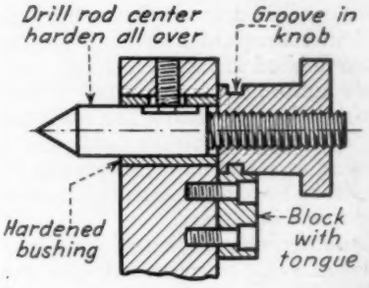
THERE ARE always a number of ways in which a given part can be located and clamped in a jig or fixture. Some of these are fast and easy to operate, and can be arranged so that the operator does not have to get into an awkward position in order to place or remove the work piece. Others, which may be entirely satisfactory for certain applications, will be found to be awkward for most classes of work. When the jig and fixture designer applies the principles of motion economy in laying out a new tool, major savings can be effected in the production departments. The examples of various types of clamping devices shown on these pages have been found to work satisfactorily.



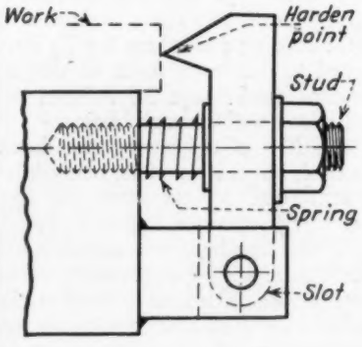
Double-acting screw clamp



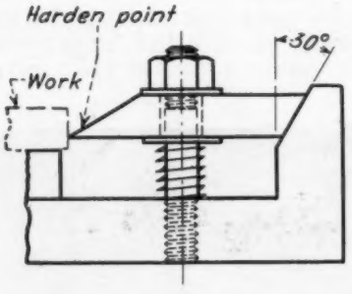
Double-acting clamp for medium work



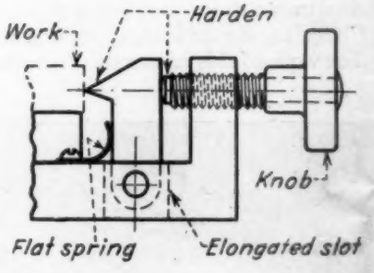
Simple center supports for light work



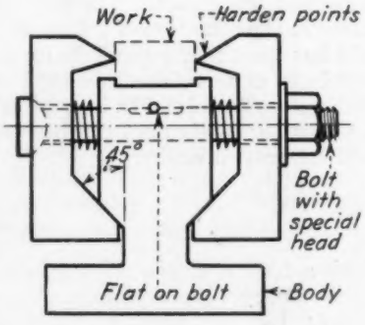
Single-action swinging pinch clamp



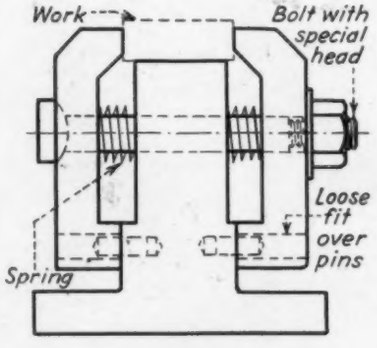
Wedge-operated pinch clamp



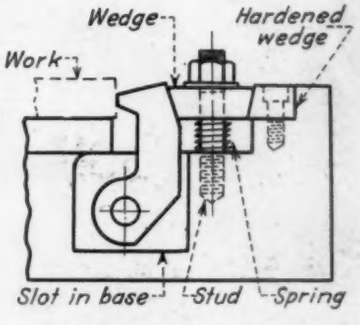
Alternate type of swinging pinch clamp



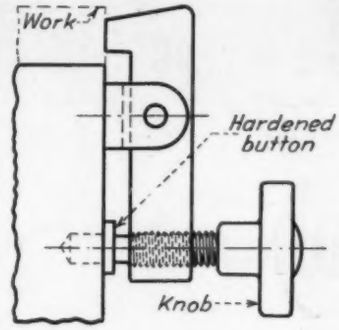
Equalizing pinch clamps hold work down



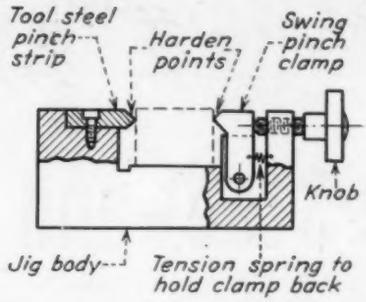
Equal clamping from two sides



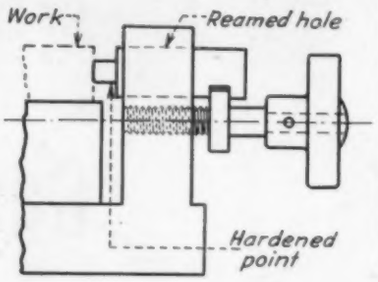
Frequently used wedge-type clamp



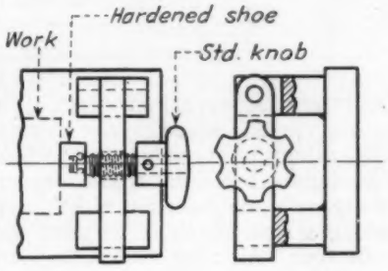
Simple screw-operated clamp



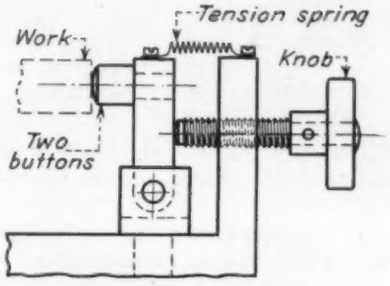
Swinging clamp with pinch strip



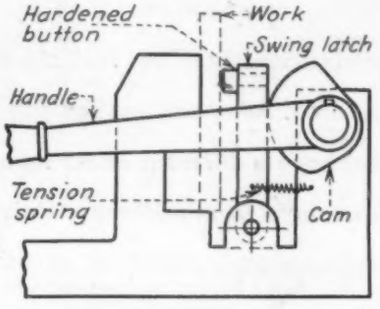
This clamp can be used as a locator



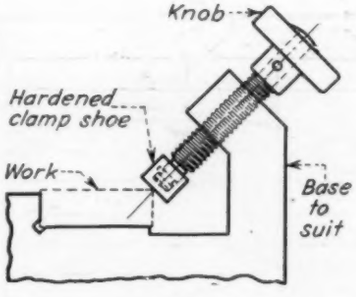
Hinge clamp for welded fixtures



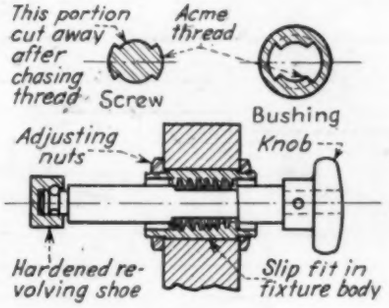
Equalizer with hardened buttons



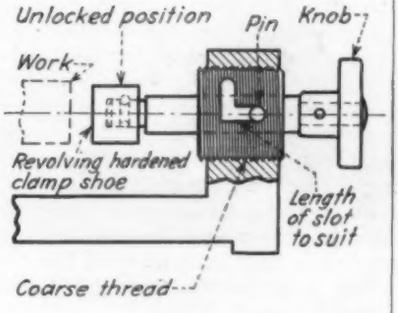
Cam-locked clamp is quick-acting



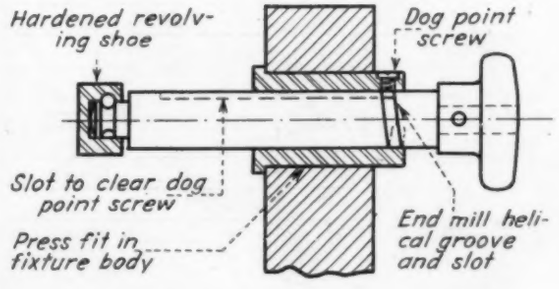
Screw-type fixture clamp



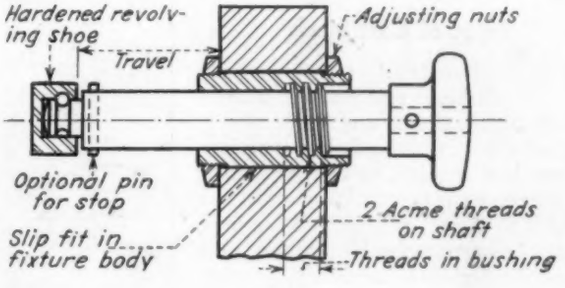
Long-travel clamp with gun lock



Quick-acting clamp with bayonet lock


Hardened revolving shoe
Dog point screw
Slot to clear dog point screw
Press fit in fixture body
End mill helical groove and slot

Long-travel clamp with cam lock



Long-travel clamp with Acme threads

Cast Steel and Iron

COMPILED BY J. G. MAGRATH, APPLIED ENGINEERING DIVISION, AIR REDUCTION COMPANY

Flame hardening has been applied successfully to cast steel and iron. Alloy and carbon content have a different effect than in wrought form of these metals

LITTLE DIFFICULTY has been encountered in flame hardening steel castings. Unmachined steel castings frequently have a decarburized surface layer resulting from reaction occurring in the mold or from normalizing. When flame hardening is to be applied to an unmachine surface of a casting, the surface should be cleaned as free of scale as possible to prevent soft spots. Because of the decarburized surface, a reduction of 30 to 40 points Brinell below the surface hardness obtainable on a machined surface may be expected. Such loss can be counteracted by raising the carbon content in unmachined castings. Flame hardening on machined castings, where such irregular surface conditions have been removed has resulted in uniformly acceptable hardnesses.

Steel castings are generally normalized and annealed for grain refinement and to reduce casting strains. They are frequently furnace hardened to improve core properties prior to flame hardening restricted surface areas.[4]

Types of Cast Steels

Cast steel contains varying percentages of carbon, manganese, silicon, phosphorus, sulphur and other alloys, and solidifies from the molten state in a a form that requires no further change of shape, except machining or other finishing. Steel castings are divided into two main classes: carbon and alloy. Each class is subdivided according to composition.

The normal percentages of the elements generally present in carbon steel castings may be listed as follows:[18]

Carbon	0.05 to approx. 1.70 percent
Manganese	0.50 to 1.00 percent
Silicon	0.20 to 0.75 percent
Phosphorus	0.05 percent max.
Sulphur	0.06 percent max.

For purposes of discussion, carbon cast steels are divided into the following classes:

1. Medium carbon cast steels, containing 0.20 to 0.40 percent carbon.
2. Special carbon cast steels—

(a) Low carbon cast steels containing any amount less than 0.20 percent carbon.

(b) High carbon cast steels containing more than 0.40 percent carbon.

Alloy steel castings may be defined as castings made from a steel to which one or more special elements have been added, or in which more than the usual percentage of a normal element (such as manganese or silicon exists. The special elements added to foundry steel, either singly or in combination, include aluminum, chromium, cobalt, copper, manganese, molybdenum, nickel, selenium, silicon, titanium, tungsten and vanadium. All alloy steel castings are divided into the following subclassifications:

1. Low-alloy cast steels, containing special alloying elements totaling less than eight percent.
2. High-alloy cast steels, containing

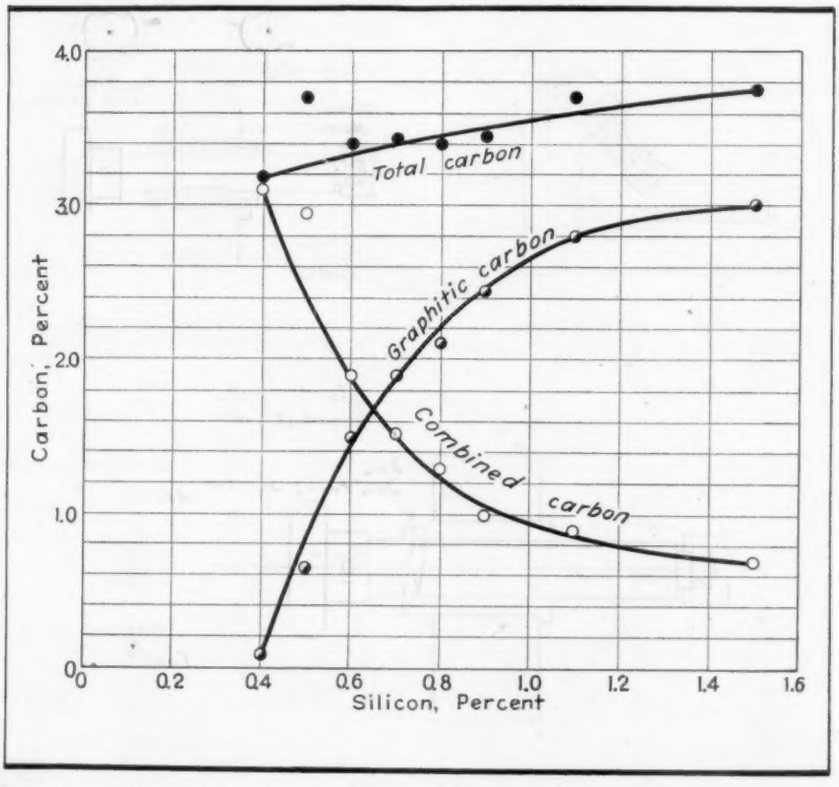
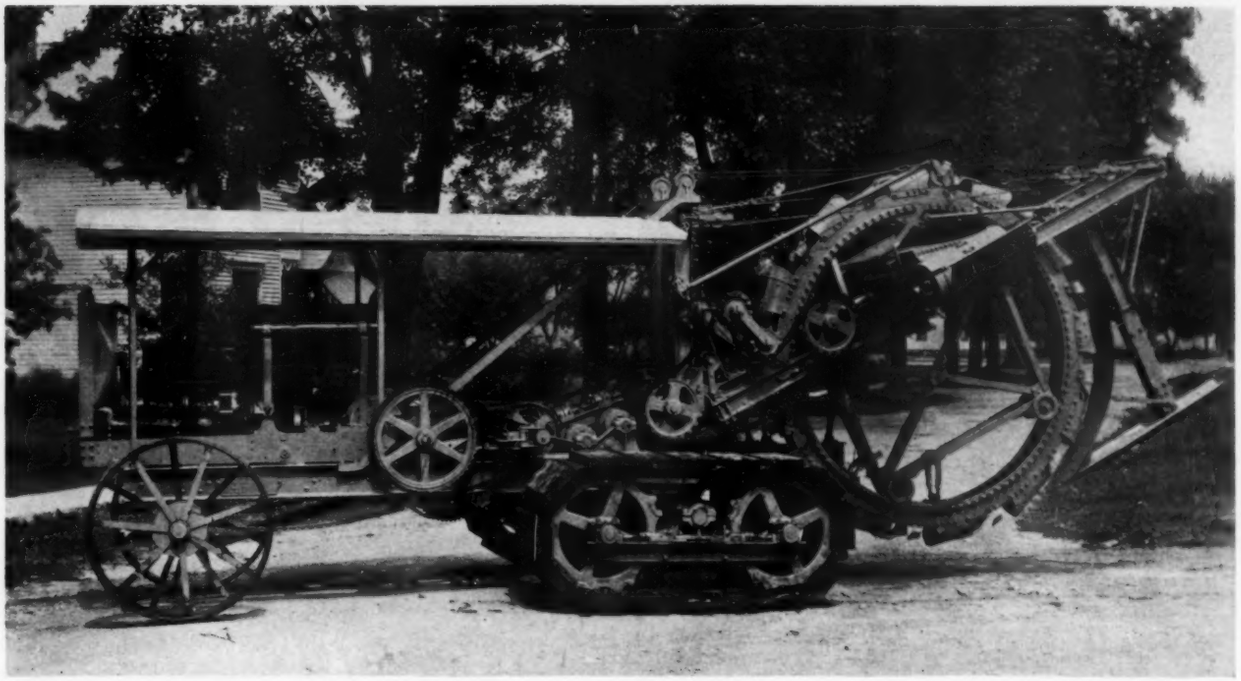
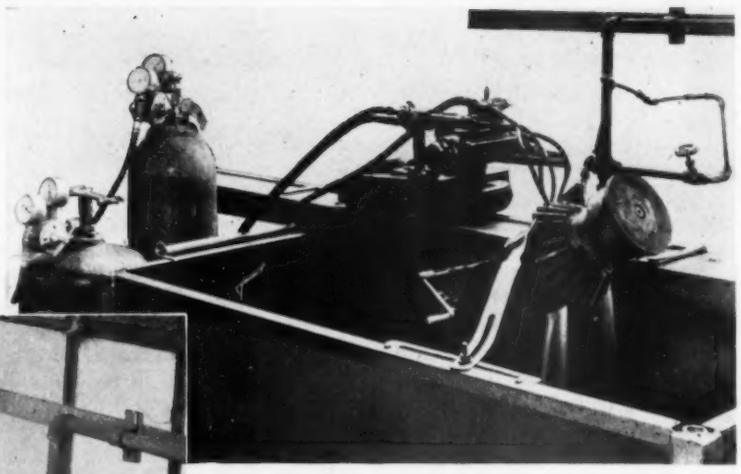


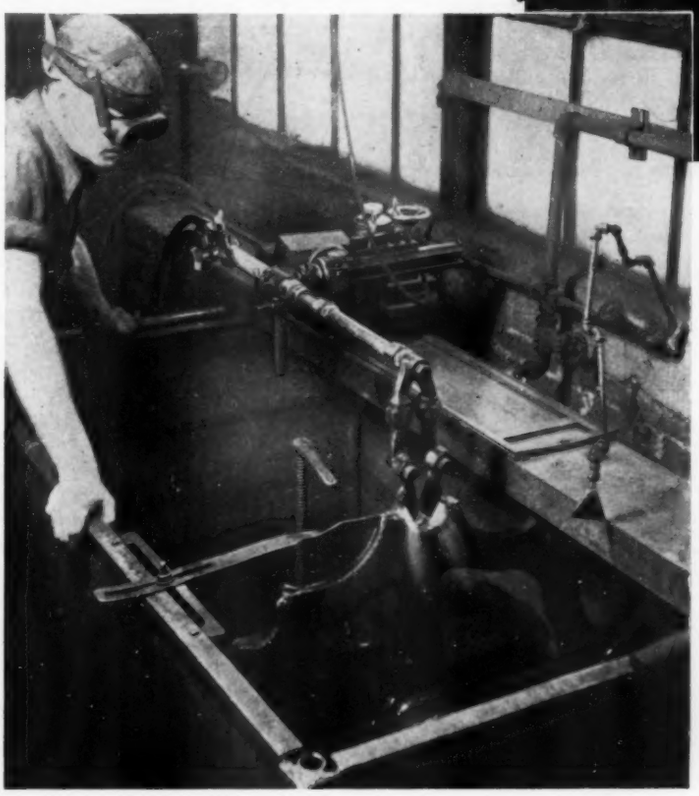
Fig. 5. Analyses *of eight cast irons show that graphitic carbon increases and combined carbon decreases as the percentage of silicon rises*



Power shovels, *trenching machines, drainage machines (illustrated), back fillers, clay loaders and other types of road machinery are built by the Buckeye Traction Ditcher Company. These machines have many sprockets, gears, pinions, hubs and clutches of various shapes and sizes made of SAE 4140 and T1335 cast steel*



A special flame-hardening tank *with adjustable mounting pedestal, traveling radiagraph and a full range of various sized tips were installed for production flame-hardening of at least 100 different pieces. Here the teeth of a cast steel bevel gear are being surface treated with a standard welding torch and two flame tips with shop-built primary and auxiliary quenches*



Inside tooth faces *of a caterpillar traction sprocket are being flame hardened. This part is used on the drainage machine shown above. Outside tooth faces for bucket conveyor sprockets are also flame hardened on the same standard apparatus*

Table VI—PLAIN CAST IRONS

Analysis					Brinell Hardness* After Water Quench
T.C.	Gr.C.	C.C.	Mn	Si	
3.32			3.52	1.13	486
3.27			0.65	1.80	514
3.38	2.67	0.71	0.74	1.23	555
2.92			0.96	1.64	555

*** Hardnesses as shown are not indicative of maximum hardness obtainable but are representative of flame hardening results using varying quenching rates to meet specific hardness specifications.**

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4. Notes on Flame Hardening by G. V. Slottman; July, 1940
13. *Cast Metals Handbook*, American Foundrymen's Association, 1940

eight percent or more of special alloying elements. This class includes the heat- and corrosion-resistant steels and austenitic manganese steel.

Cast iron is an iron containing so much carbon that, as cast, it is not usefully malleable at any temperature. It usually contains from 1.7 to 4.5 percent carbon and, in most cases, an important percentage of silicon. A.S.T.M. Tentative Specifications (A196-36T).

In cast irons, the carbon occurs in two different forms: i.e., as graphitic or temper carbon, commonly called graphite (Gr.C.) and combined carbon (C.C.). The sum of these is usually between 3.00 and 3.50 percent and is known as total carbon (T.C.). The graphitic carbon content depends largely upon the silicon content. Graphite is a good lubricant in cast iron and provides ease in machining. On the other hand, increase in combined carbon contributes to greater strength. Gray cast iron for flame hardening should contain at least 0.6 to 0.8 percent combined carbon.

Many of the plain and alloy cast irons have been successfully flame hardened. Generally speaking the hardness of cast irons is dependent on the percent of combined carbon present, and as a general rule, a combined carbon of 0.6 to 0.8 percent is recommended. However, combined carbon is not indicative of hardness obtainable as in the case of carbon content in steel; upon heating to hardening temperatures, combined carbon can revert to graphite, and under other conditions, graphite can be transformed to combined carbon. The choice of alloyed cast iron is influenced by the selection of a desirable balance of physical properties, such as machinability, fine grain, toughness, strength and rigidity. Recent investigations have shown that certain of the alloying constituents, such as molybdenum, prevent graphitization of the combined carbon on heating[13] and thus exert a considerable effect on the hardness obtainable.

Types of Cast Irons

Cast irons are broadly grouped into four classes, as follows:

1. Gray iron is cast iron having a gray fracture. It is readily machinable and generally is flame hardenable. Its combined carbon seldom exceeds 0.8 percent.

2. White iron is cast iron having a white fracture. It is hard and difficult to machine, and generally, it is not readily flame hardenable. The carbon is nearly all in the form of iron carbide. (It is heat-treated to produce malleable iron).

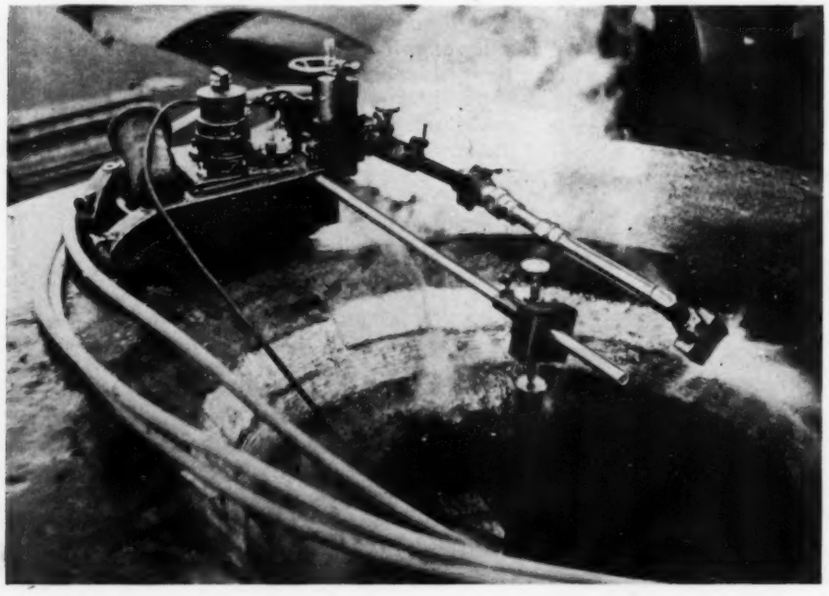
3. Mottled iron is a cast iron having a mixture of gray and white fracture.

4. Chilled cast iron has one section cooled so fast by chills that the carbon is retained in the combined form, or as a white iron, while other sections are allowed to cool naturally so that the carbon is in the same form as in gray iron. A mottled area (mixed gray and white) lies in between the white chilled and the gray portions. Ordinary chilled castings cannot be used when machined surfaces are required and where dimensional accuracy is important because of prohibitive machining costs. Chilled cast iron is not readily flame hardenable.

Several successfully flame hardened plain cast irons are shown in Table VI.

Cast iron seldom contains less than 0.5 percent and frequently as much as 3.0 to 3.5 percent silicon. Silicon promotes the formation of graphitic carbon and, therefore, increases softness. If carried too far it decreases the strength. It is used as a softener in gray iron and as a graphitizing agent in malleable castings. It raises the corrosion resistance. In flame hardening, the silicon content is usually maintained between 1.0 and 2.0 percent, depending upon the presence of other alloys.[4] Other conditions being equal, the higher the silicon (if not above 4.0 percent), the higher will be the graphite and the lower the combined carbon, and vice versa, the lower the silicon, the lower will be the graphite and the higher the combined carbon. This effect is indicated in Fig. 5.

The next installment of this series will be found in an early number.



This centrifugal pump liner *of cast steel was flame hardened in the 30 in. diameter cone neck. The steel contains about 0.45 percent carbon; the cone neck is hardened to 350 Brinell. Standard flame-hardening apparatus is mounted on a radiagraph traveling on a radius rod. At the outer circumference the tip speed is 6 in. per min. No warpage resulted. These liners are used in the pumps of dredges employed in clearing sewer beds of mud, silt and debris. It was frequently necessary to replace them every few weeks consuming four hours time and costing about $300 for a new liner. Flame hardening greatly lengthens service life*

Conveyors transport shell from operation to operation throughout the machine shop. Finished shell travel on this conveyor until paint is dry and they can be packed in cartons. Inspectors check each shell carefully

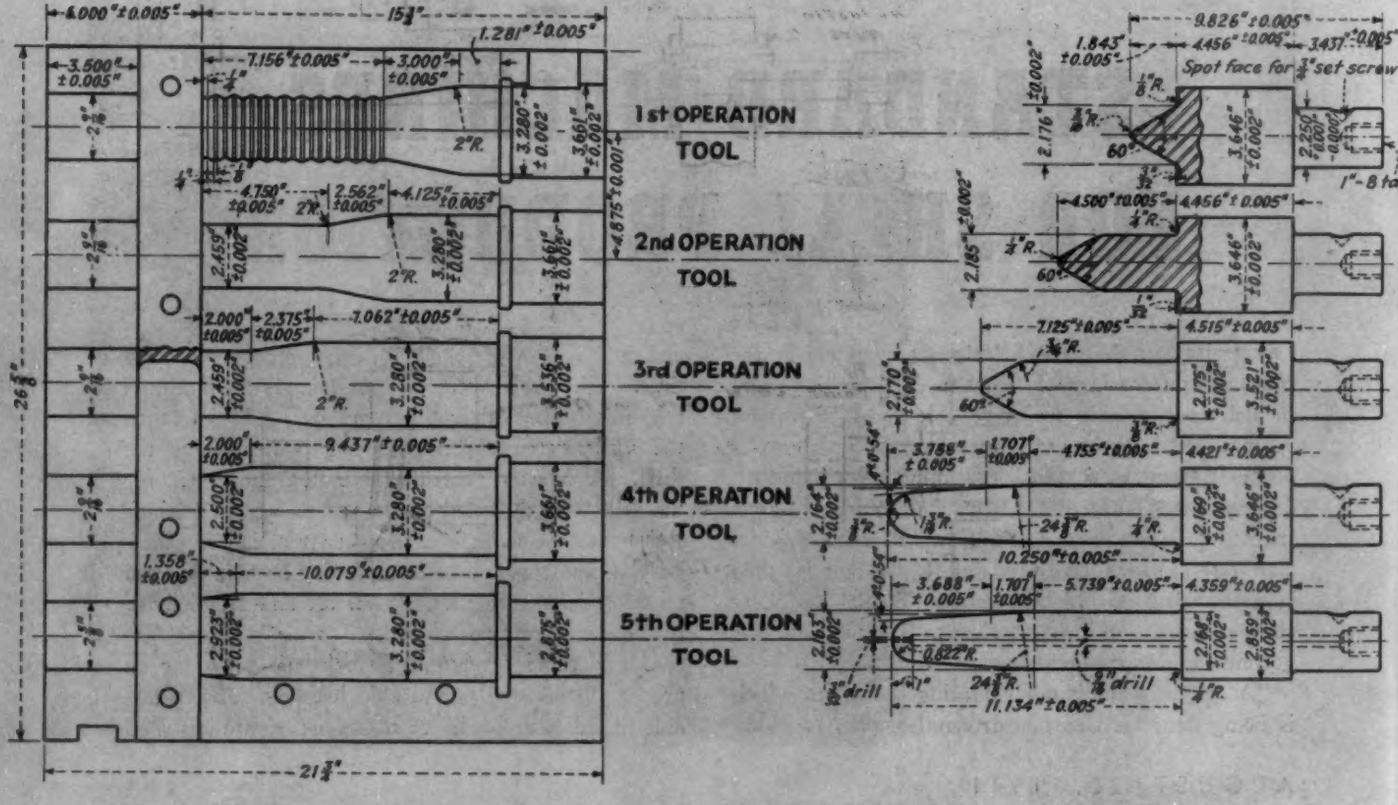
STANDARD MACHINES FOR SHELL PRODUCTION

"BY UTILIZING EQUIPMENT already available in the plant and purchasing only those machines which could be delivered quickly we were able to start forging 75-mm. shell two months after the signing of our contract," said V. A. Guebard, acting superintendent, International Harvester, Milwaukee Works. "Four months later we were meeting our machine production rate. Much credit is due J. E. Harris, then superintendent of the Milwaukee Works and now superintendent of Harvester's St. Paul Works, for getting the program under way.

"A case in point is our centering operation, which is being done on two belt-driven lathes, a LeBlond and a Niles, which had been in storage for some time. The ways were rescraped, and the machines rebuilt. Individual motor drives were added to turn the air-operated expanding arbor which holds the shell. A Master geared-head motor and chuck for the drill were mounted on the tailstock casting which is fed into the work by a Logan air cylinder. Similarly, Gisholt Simplimatics and Fay automatics used on other jobs were partially rebuilt and retooled for turning and boring operations."

Considerable development work has been done on proper cutting angles and chip breakers for the carbide-tipped tools used. A technique of forging shell

Bars heated to forging temperature in the Surface Combustion furnace are descaled between rollers before being handed to the operator at the upsetter. Shell bodies are forged in six passes. Die has five cavities, with the first two passes being made in the top cavity and then one pass being made at each succeeding cavity until finished in the lowest cavity. Operator on platform sprays oil and graphite in the die



This forging die, with the five punches shown, makes 75-mm. shell forgings. Die cavities and punch sizes are arranged to give uniform results over three working shifts; uniformity of forgings depending to a certain extent on the timing operators use in moving the billet from one cavity to the next

has been developed which has improved the life of the punches more than eight times the life secured in first attempts.

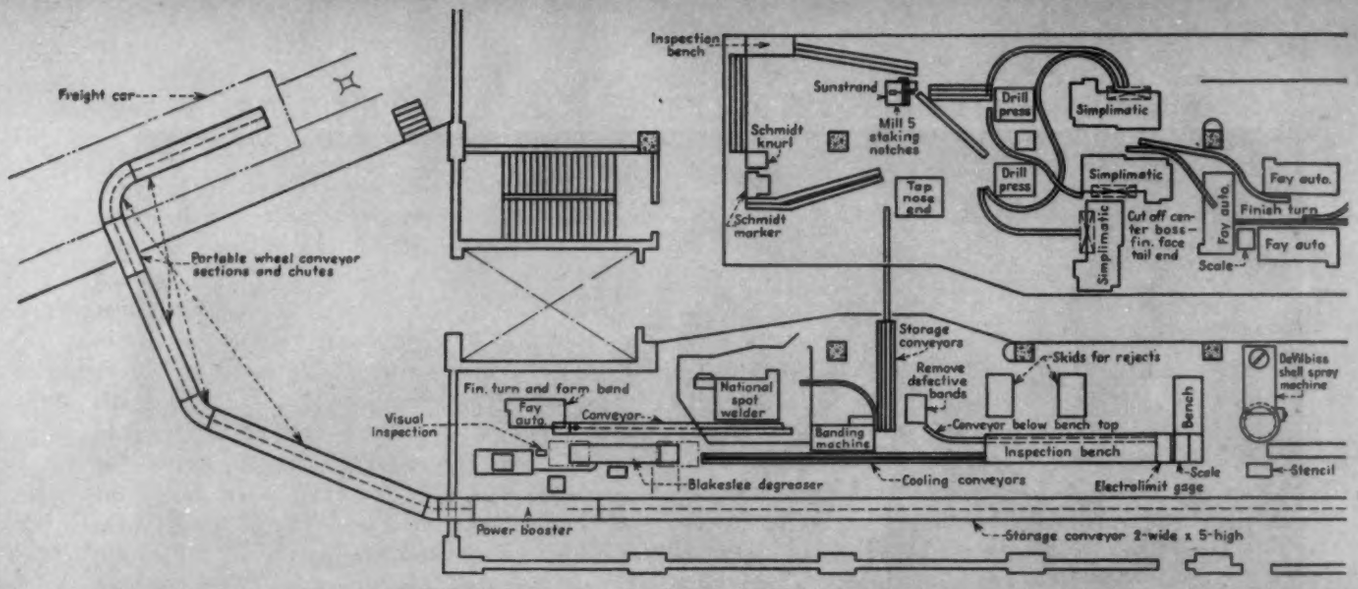
Bars of hot rolled W. D. X-1340 steel, $2\frac{7}{16}$ in. diameter and 19 ft. 2 in. long, first are delivered to a Scully cut-off machine when a $\frac{1}{4}$-in. long piece is cut from one end of each bar. This short section is deep etched to check for secondary piping. If no defects are found in this test, the bars are taken to a Williams & White press where the long bars are sheared to $28\frac{3}{4}$ in. lengths. Each of these is long enough for two shell when forged by the upsetter.

These short bar lengths are heated in an oil burning open hearth Surface Combustion furnace to about 2,200 F. Helpers take heated bars from the furnace, pass them through a roll-type descaler, and then hand them to the forging machine operator for forming the first shell. Shell are forged in a 4-in. Acme upsetter using a five cavity die and five punches. Two passes are made in the first cavity to form a collar on the open end of the forging which serves both as a stop for gaging and as a stripper for succeeding passes.

Considerable difficulty was first experienced in the forging operation because the life of the punches was too short. By proper adjustment of the relative lengths of the punches and by proper technique in cooling, the life of the No. 5 punch has been increased from 1,000 or 2,000 up to more than 17,000 shell. A spray nozzle above the punches supplies only enough water to keep them at a working temperature of about 800 to 900 F. This is far enough below the 1,150-1,250 F. drawing temperature that the hardness of the punch is not affected. If working temperature of the punch drops below 800 F. it will be cold and tend to crack. The forging die is lubricated by a standard No. 30 lubricating oil in which is mixed a small percentage of graphite or plumbago. This is sprayed into the die during the forging operation with a spray gun on an extension handle by an operator who stands on a platform above the upsetter. This helper also lifts the finished hot forging to the conveyor at his right, using long handled tongs. After the first half of the bar has been forged, the second half is returned to the furnace for reheating. Upon removal from the furnace it is descaled as before in a fixture with two knurled rolls, then it is delivered to the upsetter for forging the second shell.

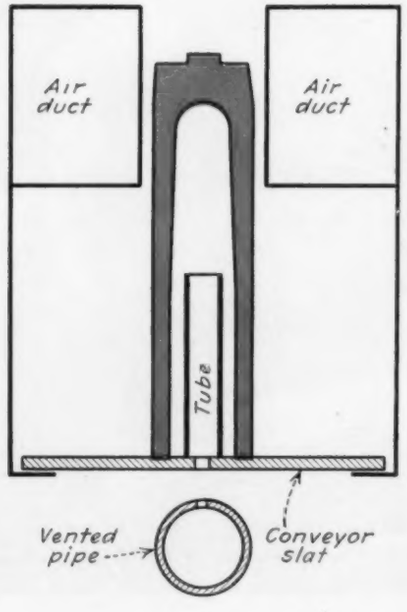
Forgings are forced-air cooled to get them to black heat as rapidly as possible—a Brinell of 212 to 228 being desired. This is done by blowing air on the forging from ducts along both sides of the cooling conveyor which carries the shell to a heavy-duty trimming press. The forgings are inverted over tubes extending vertically from the flats of the conveyor.

Shell are centered in the base end in one of two rebuilt lathes. Gear motor at the left drives the drill while the air-expanded arbor holding the shell is driven by a motor belted to the headstock. A sheet metal guard covers the drill spindle, even when it is not in use



This floor plan of the shell machining and shipping department shows the use of an extensive conveyor system, employing both spool-type roller conveyors and power-driven slat conveyors, including a five-tier conveyor which is used both for storage and delivery of cartons to the shipping platform

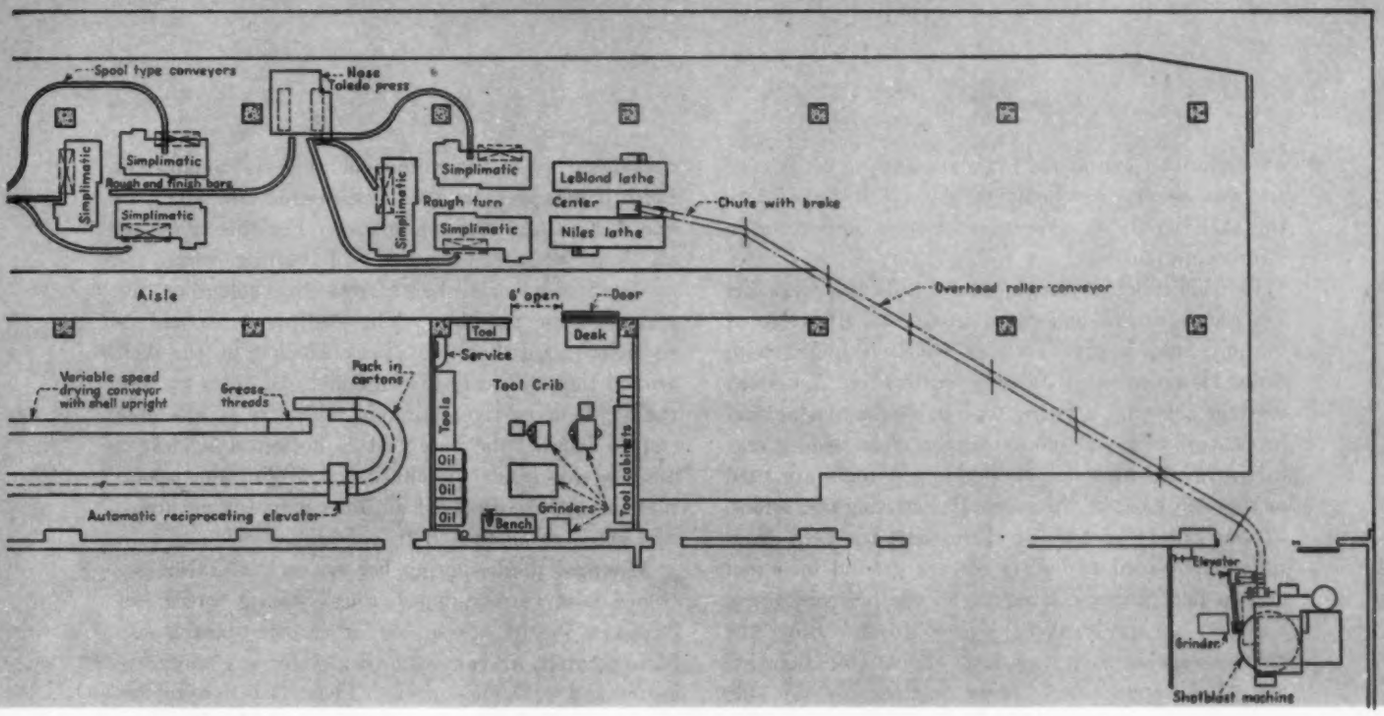
Finished shell forgings, while still very hot, are inverted over tubes on a slat-type cooling conveyor which carries them between two air ducts. While on this conveyor the shell are cooled by air blown around them from the air ducts and into the cavity through the tubes

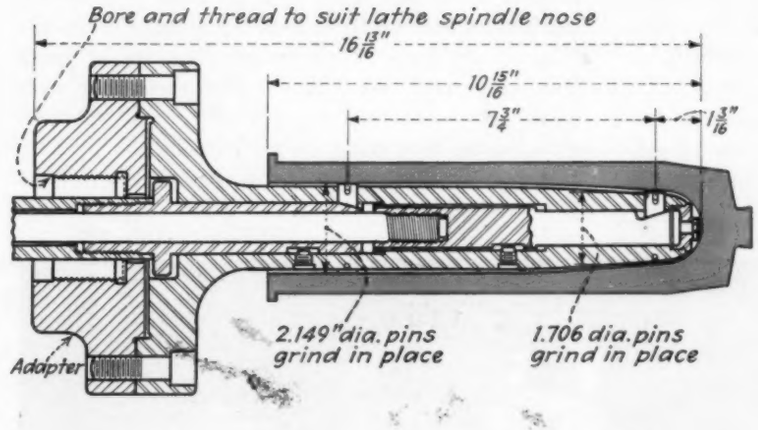


A vented air pipe is placed beneath the conveyor so that air can be blown up through the support tubes into the cavity of the forging for additional cooling. A secondary advantage of forced cooling is that it permits quicker handling of the forgings and consequently reduces the amount of floor space which otherwise would be required.

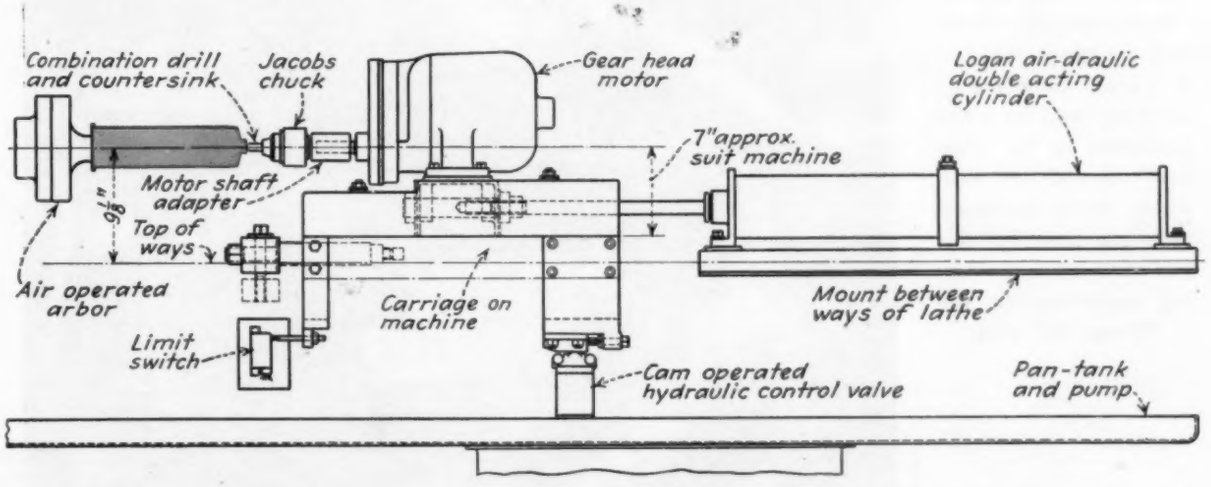
Forgings are trimmed "cold" in a Consolidated press, after which a small protrusion at the bottom of the cavity (due to a vent hole in the fifth punch of the upsetter) is flattened by a reciprocating air-driven ram. The still warm forgings then are placed on a four track roller conveyor for delivery to the Army inspection bench. This conveyor runs through a sheet metal tunnel into which cold air is blown for cooling purposes. After inspection, forgings are shotblasted in an American Wheelabrator machine. Hangers in the machine support the shell in a vertical position while nozzles in the wall clean the outside of the shell and nozzles below the hangers clean the cavities as the shell are moved in a circular path. Shell then move to the machining department via an overhead conveyor to which they are delivered by an elevator. Spool-type roller or slat conveyors are used throughout the machine shop from the shot-blast machine to a portable conveyor section which delivers cartons of finished shell inside freight cars at the other end of the plant.

The first operation in the machining department consists of centering the base end of the shell. This operation is performed in two rebuilt lathes. An air-operated expanding arbor holds the shell on the end of the lathe spindle, which is driven by an individual motor. The drill is driven by a geared motor mounted on a slide on the ways of the lathe, and is fed in and





Each of the lathes rebuilt for shell centering was equipped with a six-jaw expanding arbor which grips the shell inside the finish-forged cavity, locating the shell body from the bottom of the cavity by an adjustable stop. The six jaws in this arbor are arranged in two groups of three jaws which are spaced far enough apart to insure accurate centering of the shell. These jaws are actuated by an air cylinder at the other end of the lathe spindle



Two obsolete engine lathes were converted to special shell centering machines by replacing the regular carriage and tailstock assemblies with home-made drilling carriages, and by mounting a coolant pan, tank and pump below the bed. An air cylinder at the end of the bed feeds and returns the carriage for a complete drilling cycle, being controlled by a limit switch and a cam operated control valve

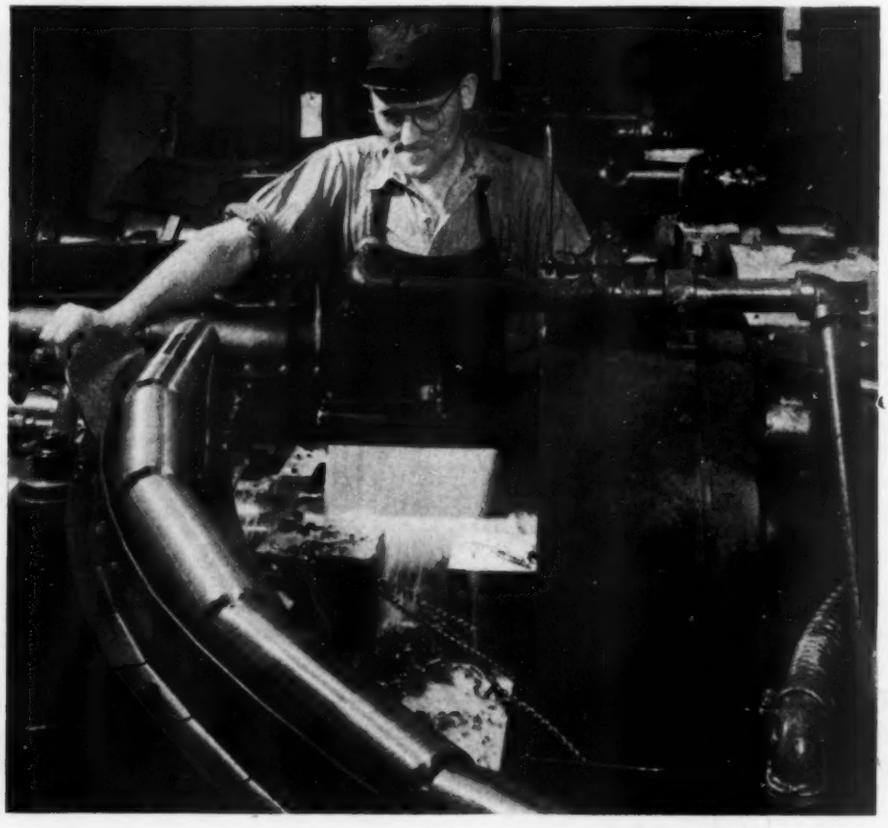
out by an air cylinder. Standard cutting oil is used for this operation. Some of this oil is forced into the shell cavity to prevent rust spots appearing in later operations.

Outside cylindrical surfaces and ends of shell bodies are rough turned and faced in one of a battery of Gisholt Simplimatics, each of which is tooled with three cam-controlled turning cutters on the front carriage and with a facing tool and a chamfering tool in each of two tool blocks on the cross-feeding rear carriage. Kennametal carbide-tipped tools are used in this and most of the succeeding cutting operations. Proper grind for each of these tools has been carefully determined and all tools are ground in a tool crib so that proper cutting angles can be maintained. Further, a chip breaker ledge is ground along the cutting edge in each tool bit. These chip breakers are of different sizes, being selected to suit the particular operation which the tool is to perform. Cutting speed for the rough turning operation is about 240 ft. per min. A water mixed compound, Solvol, is used for most of the cutting operations. The mix varies from 1 part compound with 10 to 30 parts water; the higher ratios being best.

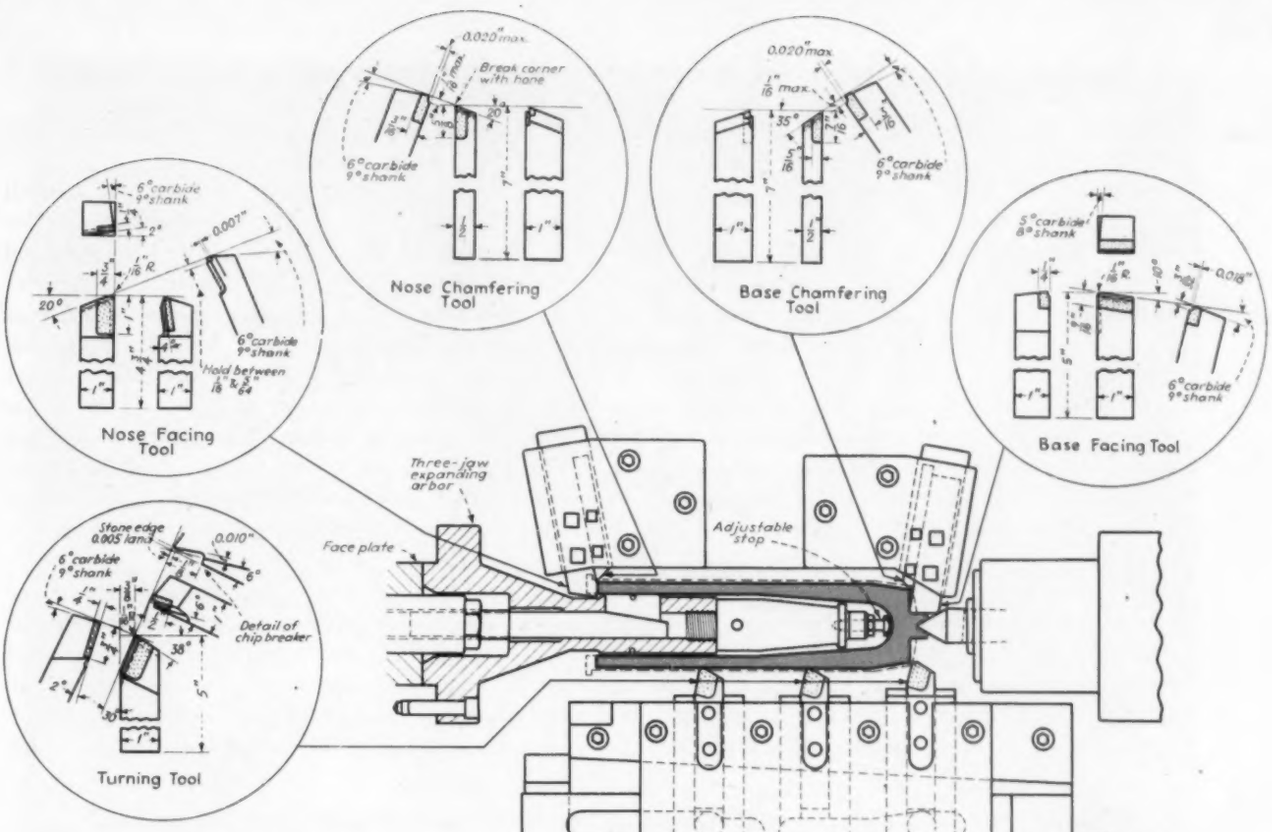
After rough turning, the shell are "nosed in" using the die shown in a No. 87 Toledo press. A sulphur chlorinated fatty oil, Superkool, is used in this operation. The closed-in end then is rough and finish bored, and the end is chamfered and faced, in one of a battery of Simplimatics. For this operation all four of the carbide-tipped cutting tools are mounted in a boring bar carried in a holder on the platen of the machine. The shell body is held in an air-operated three-jaw chuck which grips the shell around the previously turned body. In order to hold the depth of cavity accurately when facing the nose end to length, the base end is bottomed against a positive stop inside the chuck body. For this operation the shell is revolved at 300 r.p.m., giving a cutting speed of about 150 ft. per min.

Mounted in the boring bar on each of these machines is a carbide-tipped rough boring cutter set crosswise in the boring bar, a carbide-tipped finish boring cutter of conventional design, a chamfering cutter and a facing cutter. These last two cutters also are carbide-tipped and are set in keyways cut longitudinally along the bar, with the tool bodies parallel to the axis of the bar. In order to distribute the load of the cut, these tools are placed on opposite sides of the bar. Even though they are of small size, experiments have shown that these four tools work best when they are provided with ground-in chip breaker flats along the cutting edges.

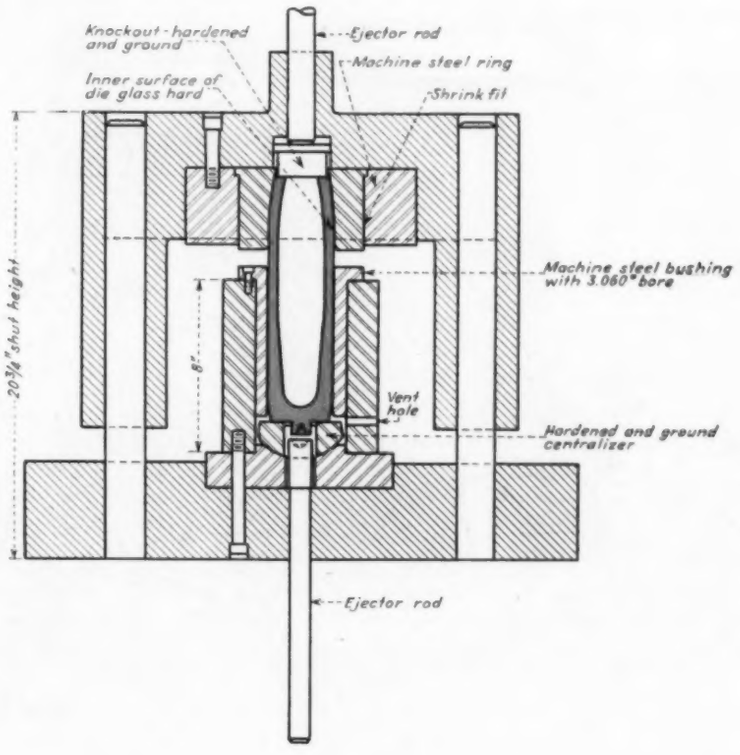
A battery of Fay automatics then finish turn the



Outside cylindrical surfaces are rough turned, and the two ends of the shell are rough faced in Gisholt Simplimatics originally used for other operations in the shop and retooled for shell work. Carbide-tipped tools are used for this and most other machining operations on the 75-mm. H.E. shell



Three cam-controlled carbide-tipped tools turn the tapered boat-tail and cylindrical body of the shell forging in the first roughing operation. The two tool holders on the rear carriage in this Gisholt Simplimatic set-up each hold two carbide tipped tools for rough facing and chamfering the two ends of the shell. This operation is performed at a speed of 240 ft. per min.



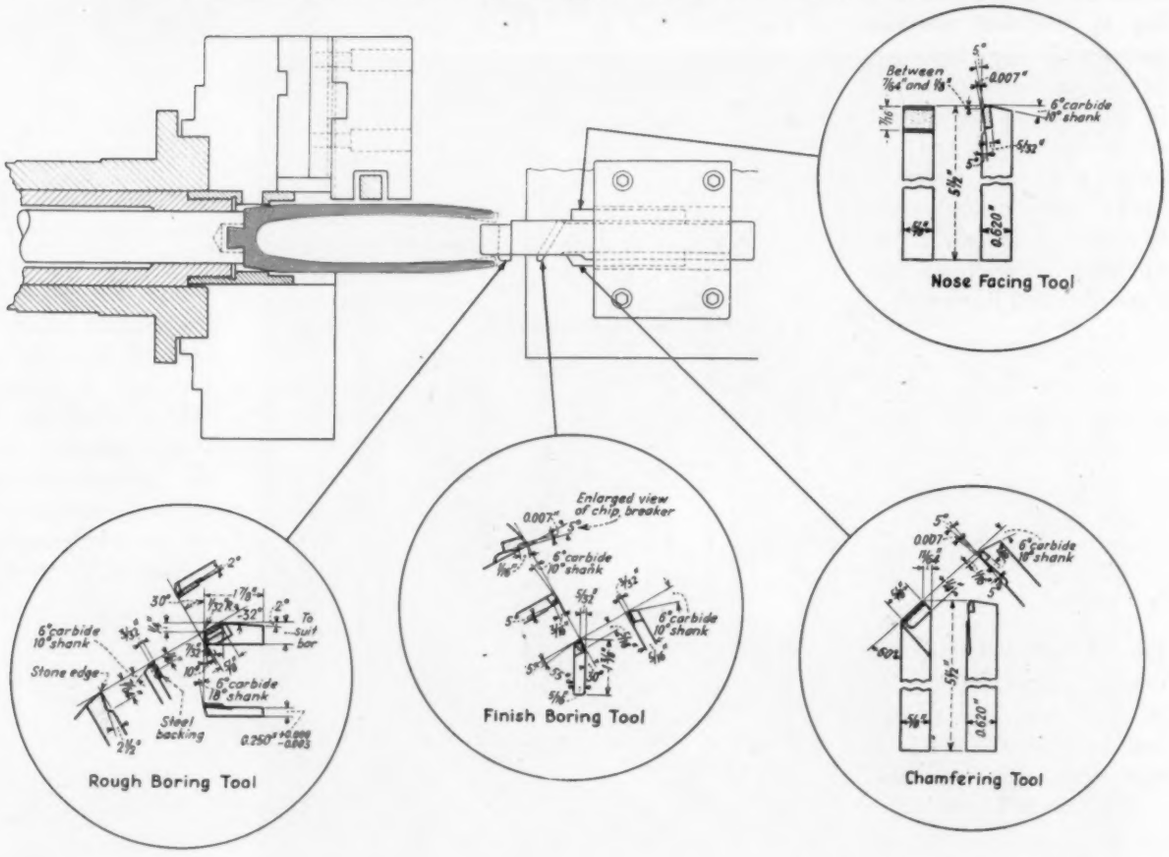
This relatively simple die assembly is used for "nosing in" the open end of the shell body in a No. 87 Toledo press. This shell does not have to be heated

body and face both ends of the shell. In these machines the shell is located from the nose end on an expanding stub arbor in the spindle of the lathe and is supported at the base end by a ball-bearing center. Cutting speed for the finish turning operation is about 326 ft. per min. with four carbide-tipped tools on the front carriage being used for turning the boat-tail taper, the cylindrical body, the bourrelet and the ogive. Two of the tools on the front carriage have a 30 deg. side cutting edge angle, while the other two are ground with a zero side cutting edge angle. In the first two tools a chip breaker ledge is ground parallel to the cutting edge, while in the two other tools the chip breaker ledge is ground in the nose of the bit at an angle of 20 deg. with the cutting edge. Two carbide-tipped tools are carried on the cross-feeding rear carriage, the one at the nose end taking a very light chamfering cut while the tool at the base end takes a finish facing cut. No chip breaker is provided in the first tool, while the second has a $\frac{1}{16}$-in. wide and $\frac{1}{32}$-in. deep chip breaker ledge ground in the carbide tip parallel with the front cutting edge.

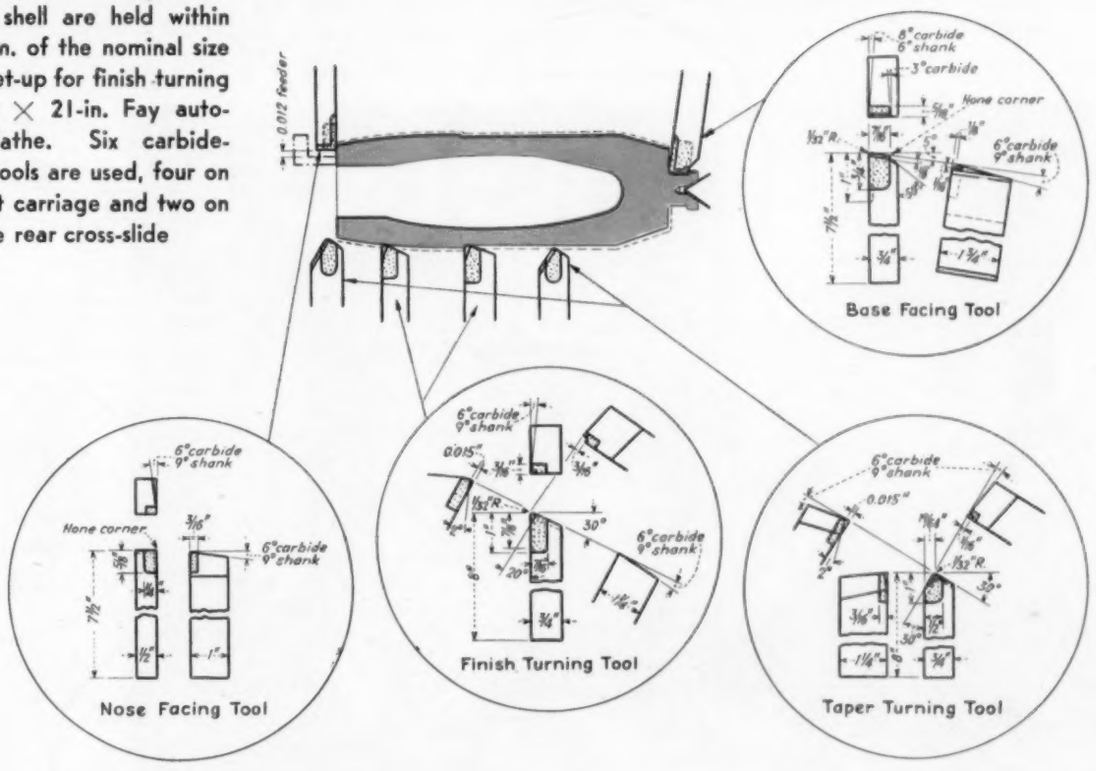
The centered boss on the base end of the shell is cut off and the band and crimping grooves are cut in the body of the shell in a battery of open-end Gisholt Simplimatics. The chucking arrangement for this operation is practically the same as that used for the nose boring operation previously performed in Gisholt Simplimatics. In this case, however, the shell body is chucked with the nose end inside the chuck, the bored nose being centered on a hardened and ground locator fitted into the spindle of the lathe. For this operation, the shell is rotated at about 300 r.p.m., giving a cutting speed of about 232 ft. per min.

On the front slide is a single tool block carrying a high-speed steel parting tool, for roughing off the boss on the base, and a carbide-tipped form tool which roughs out the band groove. In the two toolholders on the rear slide are a carbide-tipped facing tool for finishing the base of the shell and a spe-

Rough and finish boring, facing and chamfering cutters for machining the nose end of the 75-mm. shell body all are mounted in a single boring bar assembly in this Gisholt Simplimatic set-up. The 18-in. three-jaw chuck used for this operation is actuated by a double-acting air cylinder at the other end of the spindle. Like the machines used for rough turning shell, these lathes originally were used for other products

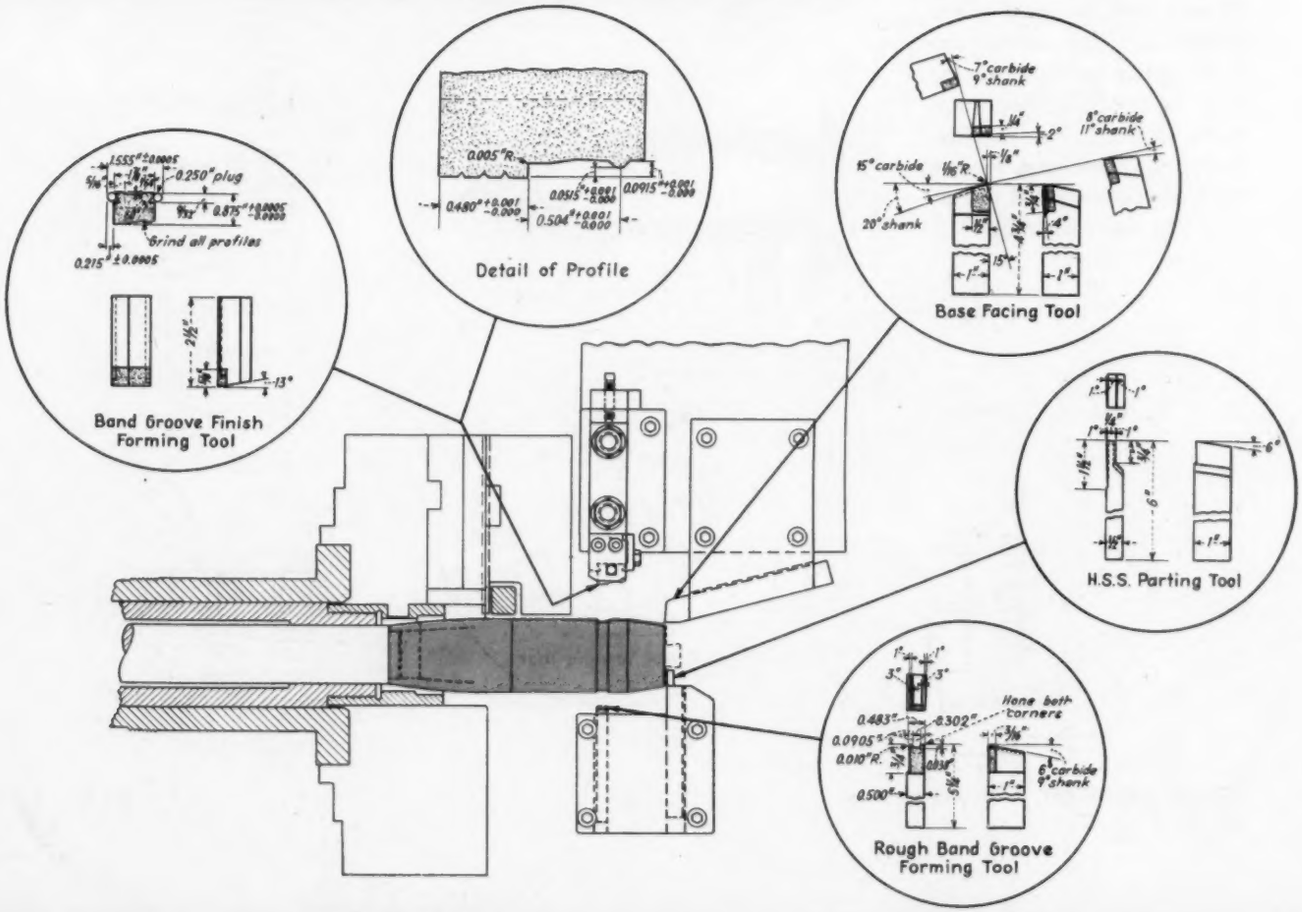


Diameters on the body of the 75-mm. shell are held within 0.0035 in. of the nominal size in this set-up for finish turning in a 12 × 21-in. Fay automatic lathe. Six carbide-tipped tools are used, four on the front carriage and two on the rear cross-slide



Base cover disks are fastened to the shell bodies by 44 overlapping butt welds. Shell are loaded in the idle fixture at one end of the work table while the shell in the second fixture turns under the four-electrode head which is reciprocated vertically eleven times to complete the welding operation. This machine is placed directly in the shell machining line, but is inclosed by sheet metal walls to protect other workers from flying sparks

This tooling layout is used for finishing the base end of the 75-mm. shell, and for form turning the band and crimping grooves. The shell body is gripped in a three-jaw, pneumatically-operated chuck and the nose end is centered on a hardened and ground plug inside the chuck body



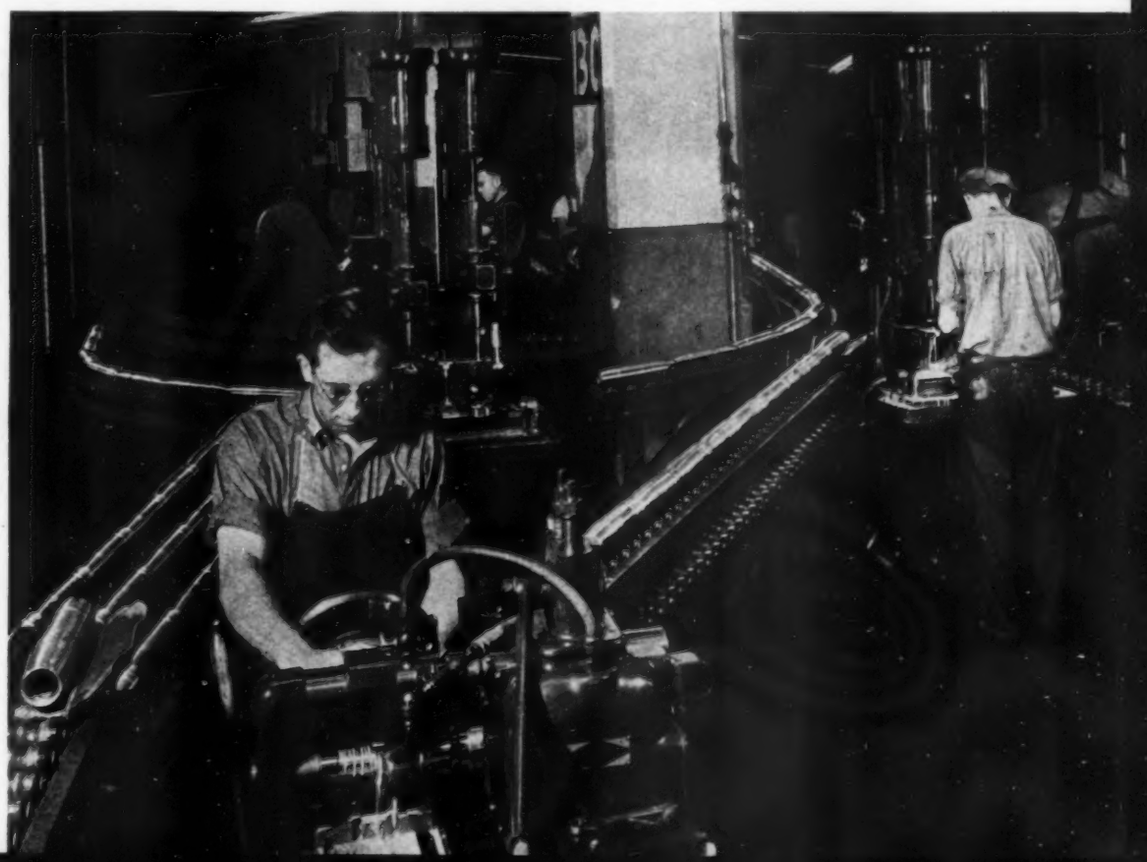
cially ground carbide-tipped form tool which finishes the band groove and cuts the single crimping groove between the band groove and the base. None of these four tools have chipbreakers. Operation cycle of this machine first feeds the front slide toward the rear of the machine to bring the two tools in the front holder into contact with the work. When these cuts have been completed the direction of feed is reversed and the form and facing tools are brought forward to complete their cuts. Feed in both directions is against positive stops for the sake of accuracy.

Succeeding operations on these 75-mm. shell include drilling and tapping the 0.3125-18NC-2 fuze setscrew hole near the nose end of the shell in an Avey two-single drill press, the shell being held in a horizontal fixture which is moved along the table of the machine to bring it successively under the drilling and the tapping spindles; milling the staking notches around the circumference of the nose end in Sundstrand horizontal milling machines; Ordnance Department inspection; knurling the band groove in Model 185 Schmidt machines; marking the identifying data on the side of the shell body in Model 195 Schmidt units; and threading the nose of the shell in Murchey horizontal double-spindle tappers. A cutting speed of about 20 ft. per min. is used for this operation.

Next, the gilding metal rotating band is compressed into place in the band groove, while the shell is held vertically in a Grotnes hydraulic banding machine. Welding of the base cover disks in position next is performed in a National spot welder installed inside a sheet metal walled room in the machining department. The head of this welder has four electrodes which make eleven welding strokes in an automatic cycle to give a total of 44 overlapping spots around the periphery of the cover disk. A two-position fixture is mounted on the table of this machine, so that the operator can unload and reload shell bodies in one position while the machine goes through its automatic welding cycle at the other position.

Shell then are placed on a spool-type conveyor which delivers them to a Fay automatic lathe for turning the rotating band. In this machine the front carriage has two carbide-tipped cutting tools, one for turning the band and the second for chamfering the front edge. Both of these tools have small chip breaker grooves ground in their cutting edges. The cross-feeding rear carriage on this Fay lathe is equipped with two carbide-tipped facing tools for cleaning up both ends of the band. These two facing tools do not require chip breaker grooves. Cutting speed is approximately 640 ft. per min., and the operation cycle of the machine is automatic, except for loading and unloading shell bodies in the collet chuck in the spindle of the lathe. A 2-in. wide strip of emery cloth is used to polish the body of the shell next to the groove to final dimensions.

A conveyor next carries the shell through a Blakeslee degreaser, from which the shell are discharged alternately to two levels of a Mathews conveyor. This conveyor carries the shell through a metal tunnel in which blowers circulate cooling air. Rub-



Several conveyor lines converge at this point to bring shell to this operator for milling the five staking notches that are spaced 72 deg. apart around the circumference of the nose end. The shell is centered and gripped in a special collet fixture for this operation

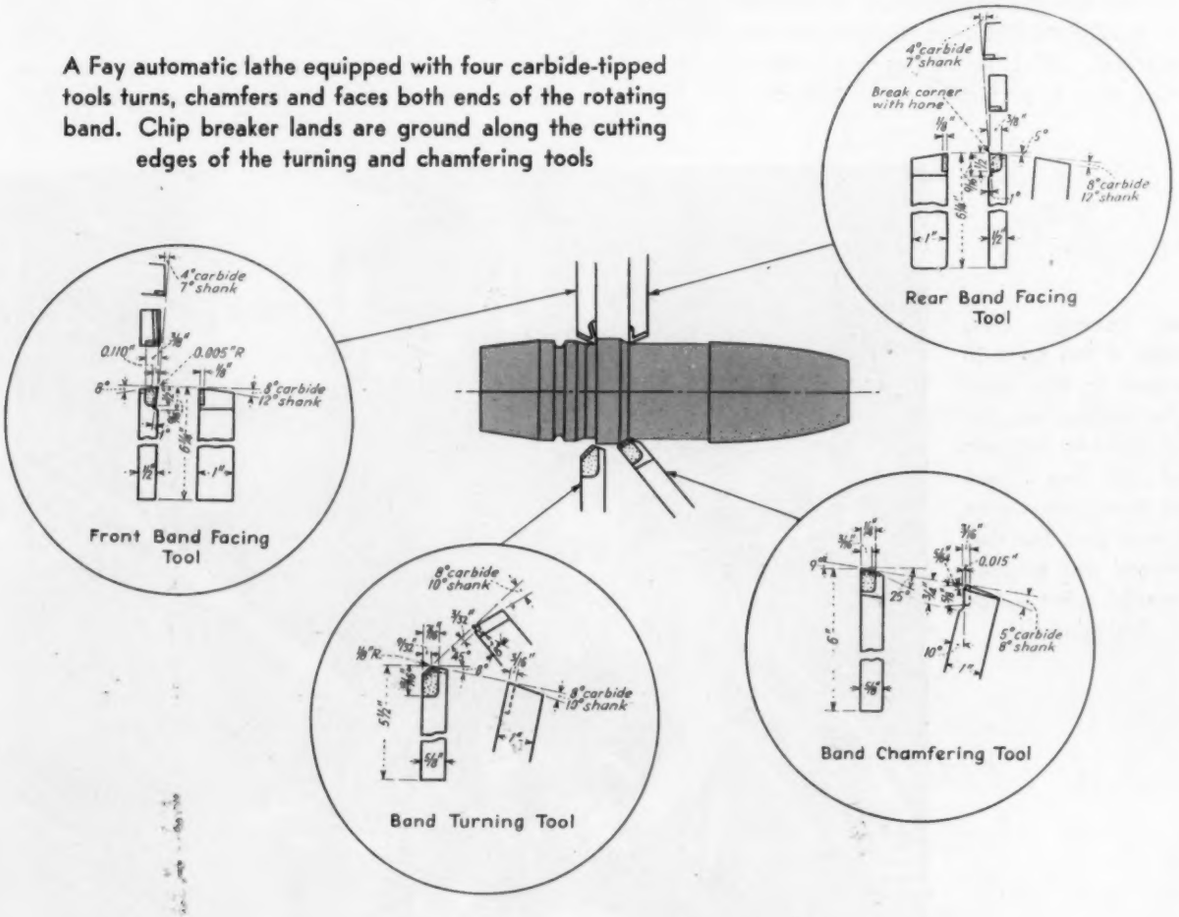
ber-covered rollers are employed in these conveyor lines. Shell emerging from the tunnel are transferred automatically to a belt conveyor where Army inspectors check all dimensions and the weight of each shell. An Electrolimit gage is used for checking external diameters. Other inspection includes: a Brinell test of 5 percent of the forgings; occasional checking of the cavity by measuring the volume of liquid it holds; and the testing of two tensile specimens from three out of every 10,000 shell. Copper bands are removed from the shell, one out of every 1,000, for a tensile test and a bend test. In this last test the band is bent 180-deg. around a mandrel, the diameter of which is equal to the band thickness.

When shell have been approved by the Army inspectors, setscrews are inserted into the tapped hole near the nose of the shell and the shell then are placed in wood partitioned tote boxes which move down a roller conveyor line to a DeVilbiss paint spray machine. This unit has a ten-station table, painting being performed automatically at the two rear stations nearest the exhaust duct. At the first painting station a nozzle descends into the cavity and sprays the interior surfaces with acid-proof paint as the shell rotates. At the next station three properly positioned guns apply yellow lacquer on the outside surfaces as the shell is turned automatically. No masking is required for the rotating band, as the shell are held in a vertical position, nose end up, by clamps which grip around the band. A bushing is placed in the open end of the shell to prevent spraying the threads. This bushing also serves to guide the nozzle which paints the inside of the shell.

Painted shell are placed over hollow pins, or tubes, on a slat-type conveyor which carries them to the packing department. As the conveyor passes over two parallel air pipes jets of air are forced up through the tubes into the shell cavities, drying the paint rapidly. When the shell are removed from this drying conveyor the threads in the nose end are swabbed with grease in line with specifications.

At the packing station along the final conveyor line these shell are packed six in a carton, then the cartons are taken by conveyor to an automatic reciprocating elevator which delivers the packed shell cartons to one of five levels of a multiple Mathews conveyor running the full length of one wall of the shop. Shell in cartons are kept on these five conveyor lines until a sufficient stock has accumulated for a carload shipment. When a car is to be loaded, roller conveyor extensions connect one or another of the levels of this multiple conveyor directly with the shipping platform from where portable conveyor sections deliver the cartons into the car.

A Fay automatic lathe equipped with four carbide-tipped tools turns, chamfers and faces both ends of the rotating band. Chip breaker lands are ground along the cutting edges of the turning and chamfering tools



Each shell is given a 100 percent inspection by Ordnance Department inspectors before it can be painted and shipped. One man operates both the Electrolimit gage for checking diameters and the adjacent scale for checking weight. Shell on the table have been passed, are ready for inserting set-screws and painting

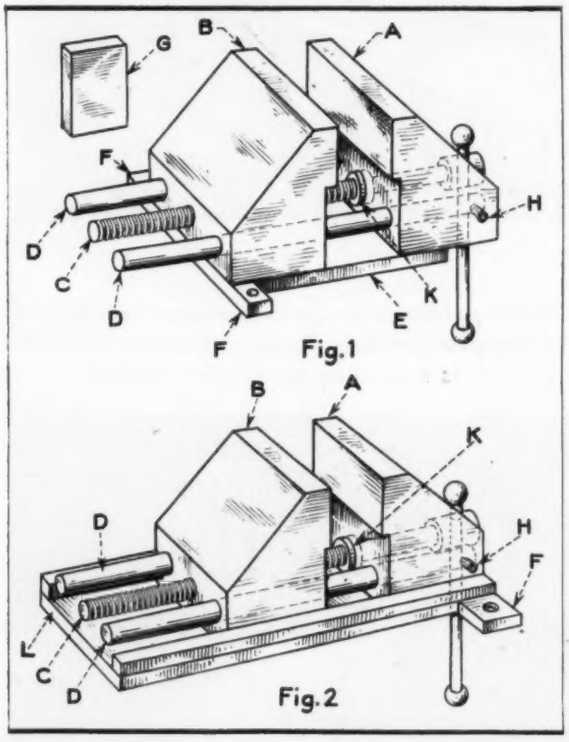
This DeVilbiss automatic paint-spraying machine has two spraying stations. At the first, the cavity is coated with an acid-proof paint, while at the next spray station three guns automatically coat all exterior surfaces with yellow lacquer, except for the rotating band which is masked by the support clamps

IDEAS FROM PRACTICAL MEN

Heavy-Duty Vises for the Drill Press

BY W. E. ABBOTT

The vises shown in the drawing were designed for the drill press, and are much more useful than the device commonly used since no wrench is required to secure the work. The vise shown in Fig. 1 consists of 6x6-in. jaws *A* and *B*, threaded rod *C* with a head for the tightening bolt similar to that used on



These vises, designed for the drill press, have guide rods to maintain alignment and are strong enough to hold work when drilling very large holes

standard bench vises, two round 1½-in. rods *D* that act as guides and plate *E* upon which the vise rests. The size of plate *E* is determined by location of slots or holes in the drill table; this plate has lugs *F*, which are drilled for hold-down bolts. Plate *G* is inserted under rods *D* and *C* between the jaws when the vise is extended.

Jaw *B* is welded to plate *E*, and is bored so that the guide rods *D* move freely in it. Also, Jaw *B* is threaded with square threads for screw *C*. Jaw *A* is movable, and as the vise is mounted near the end of a round table, it moves out to overhang the table when opened to permit securing angles or work to be drilled at one end, when such work is not longer than the distance from the floor to the highest level that drill table can be raised. Rods *D* are secured in jaw *A* by setscrews *H*, while screw *B* has a collar *K* to push jaw *A* outward when the vise is to be opened.

The vise shown in Fig. 2 is similar to the one shown in Fig. 1, but jaw *A* is fixed while jaw *B* is movable in the ways *L* built up from square stock and welded together.

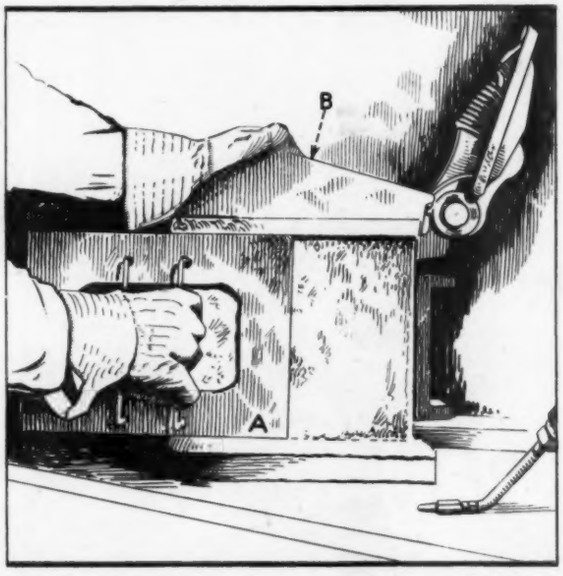
These vises can be used on a radial drill with oblong or square tables, and are designed to hold heavy work when large holes are to be drilled.

Gage Simplifies Welding Truck Boxes

BY ARTHUR HAVENS

Among the several articles that are welded in railroad car shops of the country are the sides and flanges of truck boxes. The customary practice is to rebuild these flanges well above the desired amount and send them to the machine shop where the channels are planed to the correct size. The illustrated gage *A* eliminates this machine work.

A visual examination will show the welder on which side of the truck box *B* the major wear has occurred. This side is rebuilt first. The side with the lesser wear is then rebuilt, and gage *A* is used to determine the correct thickness of the deposit. If the applied metal is found to be a trifle high when



Railroad-car truck boxes need not be machined after the flanges and sides have been rebuilt by welding. This gage is used to determine the weld deposit. High spots in the weld can be leveled with a hand hammer

the gage is tried, the bronze is beaten down with a hand hammer.

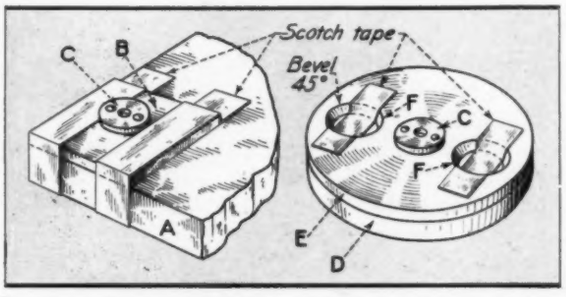
The gage is made of $\frac{3}{16}$-in. boiler steel and is $\frac{1}{16}$ in. wider than the pedestal that fits in the box. The center of the gage is removed with a cutting torch to lighten it. Two pieces of $\frac{1}{4}$-in. welding rod are bent into handles and welded to the plate so that the gage can be handled easily when working on a hot box. Barring breakage, rebuilt boxes can be used indefinitely.

Drill Bushings Held With Scotch Tape

BY FRED H. COLVIN

An instrument manufacturer recently had to make a small quantity of duplicate parts that required drilling; however, the number of pieces needed did not warrant the making of a special drill jig. Therefore, he devised the simple drill bushing described here and held them to the work with Sotch tape. Although the feasibility of using the tape was first questioned, it was tried and proved to be entirely satisfactory.

The first job was the drilling of some small holes



These two simple drill bushings, riveted to pieces of celluloid, are held to the work by Scotch tape. Within the limits of accuracy required, this proved satisfactory

in a rather large sheet of plastic *A* at points that had been laid out carefully and marked with small cross lines. While this was not an ultra precision job, the holes had to be located with considerable accuracy for this class of work.

So the toolmaker took a square piece of celluloid *B* about $\frac{1}{16}$ in. thick and riveted a small steel drill bushing *C* in the center. One of the holes had to be in the corner about 2 in. from either side so he made the celluloid square *B* 4 in. each way. The lines on the work *A* were scribed long enough in both directions to be seen outside the steel drill bushing in the center, so they could be located accurately without depending on the squareness of the piece of celluloid.

Locating the jig plate by the cross lines, it was held in place by two pieces of Scotch tape as shown. This is easily and quickly applied and removed. Furthermore it can be used over and over again.

Another job was in locating a similar drill jig over a graduated dial *D*. As shown in Fig. 2, the celluloid sheet or disk *E* that was used to hold the bushing permitted the graduations to be seen and made it easy to locate the drill plate quite accurately.

In this case, however, it was not easy to put the tape over the edge of the work. So 1-in. holes *F* were drilled through the disk and countersunk about 45 deg. to give a good slope on the sides. This made it easy to press the Scotch tape through the holes into firm contact with the work. The number of holes which determine the contact for the tape can be made to suit the job, and it will be found to help out in many jobs where clamping by ordinary methods is not convenient.

This same method has also been used in holding the drill bushing plate to metal as well as to plastics. The only requirement is that the metal shall be free from grease. It need not be polished or even particularly smooth. It can be used in many places and holds pieces together more firmly than might be imagined.

Attention to Details Makes a Better Machine

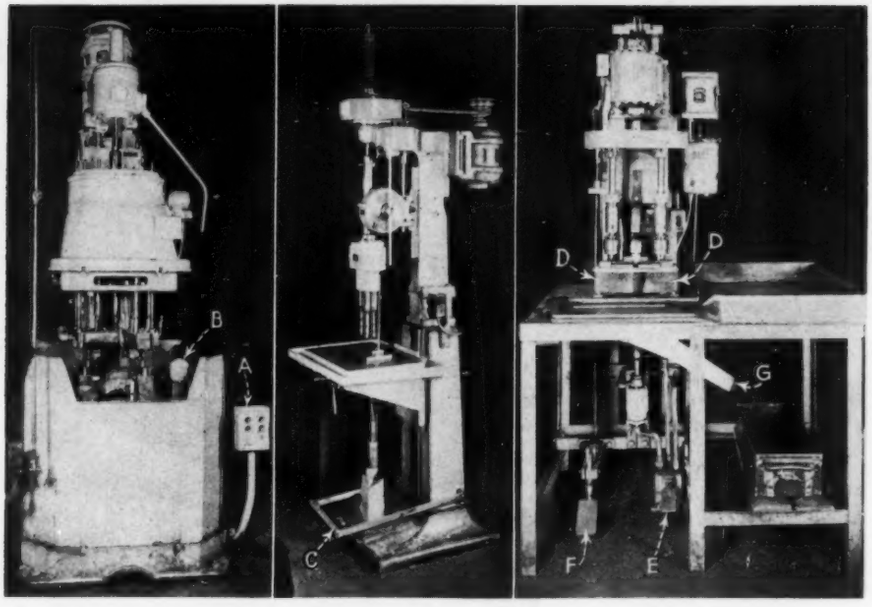
BY O. W. HABEL

Simple change in a machine can be made frequently which will facilitate its operation and decrease operator fatigue, thereby resulting in a natural increase of production. Three such examples are shown here.

At the left of the illustration is shown a machine for drilling, spot-facing and countersinking a housing. The machine as originally arranged required the operator to turn his head and body to locate the small starting button *A* with his eyes before he pushed it each time the machine went through its cycle. By placing a large starting button *B* close to where his hand would normally be, he now pushes the button without turning his head or body or locating it with his eyes. By thus keeping the operator's movements within a normal working space, and eliminating hard-to-find controls, this simple change resulted in a three percent labor saving.

The machine shown at the center of the illustration is used for countersinking four holes in a flange. As originally arranged, the operator had to advance the drill-head to the work with his right hand, while he placed and removed the work with his left hand. By adding the foot lever *C*, he now places the work with his left hand and removes it with his right, the foot lever advancing the drill head to the work. By thus replacing hand movement with a foot movement and making both hands available for useful work, a labor saving of 47 percent was made.

The machine shown at the right of the illustration, used for rethreading ball studs, is a standard two-spindle threader without a lead screw. As originally installed, the operator was required to place the part in a fixture with one hand, clamp the part in the fixture by a handwheel with the other hand, advance the fixture to the die-heads by hand, retract the fixtures from the die-heads by hand, unclamp the fixture with his left hand, and remove the part and throw it in a pan with his right hand. He also had to move his



The addition of an easy-to-find starting button on the machine at the left, a foot lever for advancing the drill-head on the center machine, and seven alterations in the machine at the right decreased operator's fatigue in each instance, and resulted in labor savings of 3, 47 and 43 per cent respectively

body from one side of the machine to the other, during each operating cycle. Loading and unloading each fixture separately, and using his eyes a great deal to direct his hand movements, resulted in operator fatigue and low production.

The machine was rebuilt by men schooled in motion economy. The operator now places parts in bell-mouthed fixtures *D*, two at a time, one in each hand. Parts are clamped and unclamped by an air cylinder operated by the right foot pedal *E*. The die heads are advanced and retracted from the fixtures by means of a counterweight and the left foot pedal *F*. The finished parts drop into a pan under the machine automatically by means of discharge chute *G*.

Eight principles of motion economy were involved in rebuilding this machine: (1) Hand movement replaced by foot movement; (2) Movements are combined by controls with multiple function; (3) Drop discharge is provided for finished work. (4) Movements are kept within a normal work space. (5) Barriers are eliminated. (6) Both hands are used for useful work. (7) Location is aided by use of bell-mouthed fixtures. (8) Use of eyes is kept within a minimum area. The adaptation of these principles in redesigning this machine resulted in a 46 per cent labor saving.

Chip Guards Made From Plastics

By LAURENCE F. SOUTHWICK

While turning a bronze casting at high speed with a carboloy tool, I was annoyed with the spray of fine granular chips shooting away from the tool point into my face and over my bare arms. The goggles I was wearing did not add to my comfort, dripping as they were with perspiration. A face shield did not prove to be much better. So I decided to devise a chip guard made of transparent plastic material which could be attached to the toolpost. To check the effectiveness of the idea, I clipped the face shield to the toolpost with a pinch-type clothespin. Not a chip escaped. The stream sprayed into the hollow of the shield and dropped back through the lathe bed.

The face shield was, of course, very clumsy and fell off frequently. Therefore, I took a piece of 0.010-in. plastic, formed it roughly into a cylinder, and ran a piece of acetone along the joint. I closed the ends of the cylinder with a disk, by feathering the edges of the disk, bending the feathers in, and cementing them against the walls of the cylinder. A cut-out enabled the cylinder to be fitted over the toolpost, with the open end toward the work; a piece of metal inside weighted it down on the carriage.

Since then, many shapes of this material have been cemented for different work pieces and different machine tools. The best pattern is decided only after a study of each problem. Forming and cementing the material is easy and quick, and it is inexpensive. These shields prevent spraying of priority materials over the shop floor, aside from being an effective safety shield.

Such shields will not stand very hot and heavy steel chips, but will turn back almost everything else. Avoid pockets in which hot chips may collect, since the material is thermoplastic and will deform and lose transparency in such places. Another construction to be avoided is an outward-facing concave surface, especially if the light is in line with it. It acts like a condensing mirror, and prevents a bad glare to the vision of the operator. Convex surfaces present only lines or points of light which are not troublesome.

These guards may be made with wooden or metal frames. The material is very easy to handle, and angles, channels, tubing and other standard shapes may be formed readily over the frames. It frequently helps to soak the plastic material in water for a couple of hours, and while wet, cemented in place around the frame. When it dries it will be stretched tight.

Paint Finishes on Metal Parts

BY JOHN SASSO

COMMON FINISHING TROUBLES can often be overcome through simple manipulations and changes with a loss of a minimum of production time. Typical defects which appear from time to time are listed, along with their probable causes and suggested remedies. Of course, proper cleaning and treatment of the surface prior to the finishing operation is essential.

Flow, drying time and gloss are dependent to a great extent upon the choice of a proper solvent. Industrial reducers are listed below with an index of evaporation rate and solvent strength. Knowledge of reducers and their use is often helpful in adjusting application procedures to overcome defects caused by local or atmospheric conditions. If the finish tends to run off, a faster evaporating reducer from the same group is needed. Orange peel may be minimized by using a slower evaporating thinner. On cold surfaces a faster evaporating reducer from the same group should be used; on warm surfaces a slower thinner gives proper flow. If dip tank material tends to separate or body, a stronger solvent may be needed, consult manufacturer.

A—LACK OF FLOW

When the paint mixture is insufficiently reduced, this trouble may occur. In some cases where local weather conditions cause fast evaporation, a slower solvent must be specified. Lack of flow may also be due to excessive temperature variations. Finishing should be done at normal temperatures around 75 F.

B—POOR DRYING

Humid or cool weather are sometimes responsible for this condition, or an unclean surface may be the cause. Other points that should be investigated include failure to stir pigment into proper suspension, which unbalances the formula, or improper ventilation or the use of the wrong solvent, for instance a fast evaporating solvent may cause surface drying and entrap solvent.

C—SAGGING FILM

Usually caused by over-reduction or use of too slow a solvent, or by application of too-heavy coats. Avoid application in strong sunlight which will cause top drying and slippage of film on vertical surfaces. Check spray gun performance.

D—LACK OF HIDING POWER

When the surface is cold and smooth, the film will tend to flow off. This case requires the use of a faster evaporating solvent. Perhaps the pigment has not been stirred enough.

E—LACK OF ADHESION

Certain metals, such as galvanized iron, cadmium, zinc are difficult to coat. In other cases, over-addition of drier will reduce the toughness of the film. In some cases the finish coat and the primer coat cannot be used together as the solvent in the finish coat may lift the primer from the surface. Overbaking also accelerates the loss of flexibility.

F—FLAT SPOTS

Can be caused by improper oven ventilation so that temperatures are not the same throughout oven, as a result overbaking may occur in some parts. In addition, make sure that the surface is properly cleaned, before finishing, to remove foreign chemicals. With urea enamels, trichlorathylene degreaser fumes cause flatting.

G—CRAZING OF FILM

Can be caused by heavy coats, or by sudden chilling of film. Keep drying room temperature constant and avoid drafts. Also check oven ventilation to avoid foul gases.

H—BLUSHING OF LACQUERS

May be caused by a combination of factors which include humidity, drafts, poor thinner, spraying of cold lacquer, moisture in equipment or damp spray rooms.

I—PIN HOLES IN FINISH

Surface drying may cause solvent to break through the surface film, or moisture in the apparatus, or too fast evaporating thinner. Determine if surface is porous or if filler is incompletely dried.

TABLE OF INDUSTRIAL REDUCERS

GROUP	Relative Evaporation Rate*	Relative Solvent Strength**
1. Hi Test Petroleum Naptha	0.75	35
VM & P Naptha	2.0	35
Mineral Spirits	11.0	35
Retarding Mineral Spirit	90.0	40
Kerosene	90.0	31
2. Hi Solvency Naptha No. 1.	1.0	79
Hi Solvency Naptha No. 2.	4.5	80
Hi Solvency Naptha No. 3.	18.0	72
3. Denatured Alcohol	1.5	(spirit finishes only)
4. Toluol	1.0	95
Solvent Naphtha	3.0	90
Hi Flash Naphtha	7.0	78
5. Gum Spirits of Turpentine	6.0	61
Wood Turpentine	6.0	65
Dipentene	10.5	66

* Measured by time in minutes for one drop to evaporate from filter paper

** Kauri-Butanol value: a general indication of solvent strength—the higher the number the greater the strength

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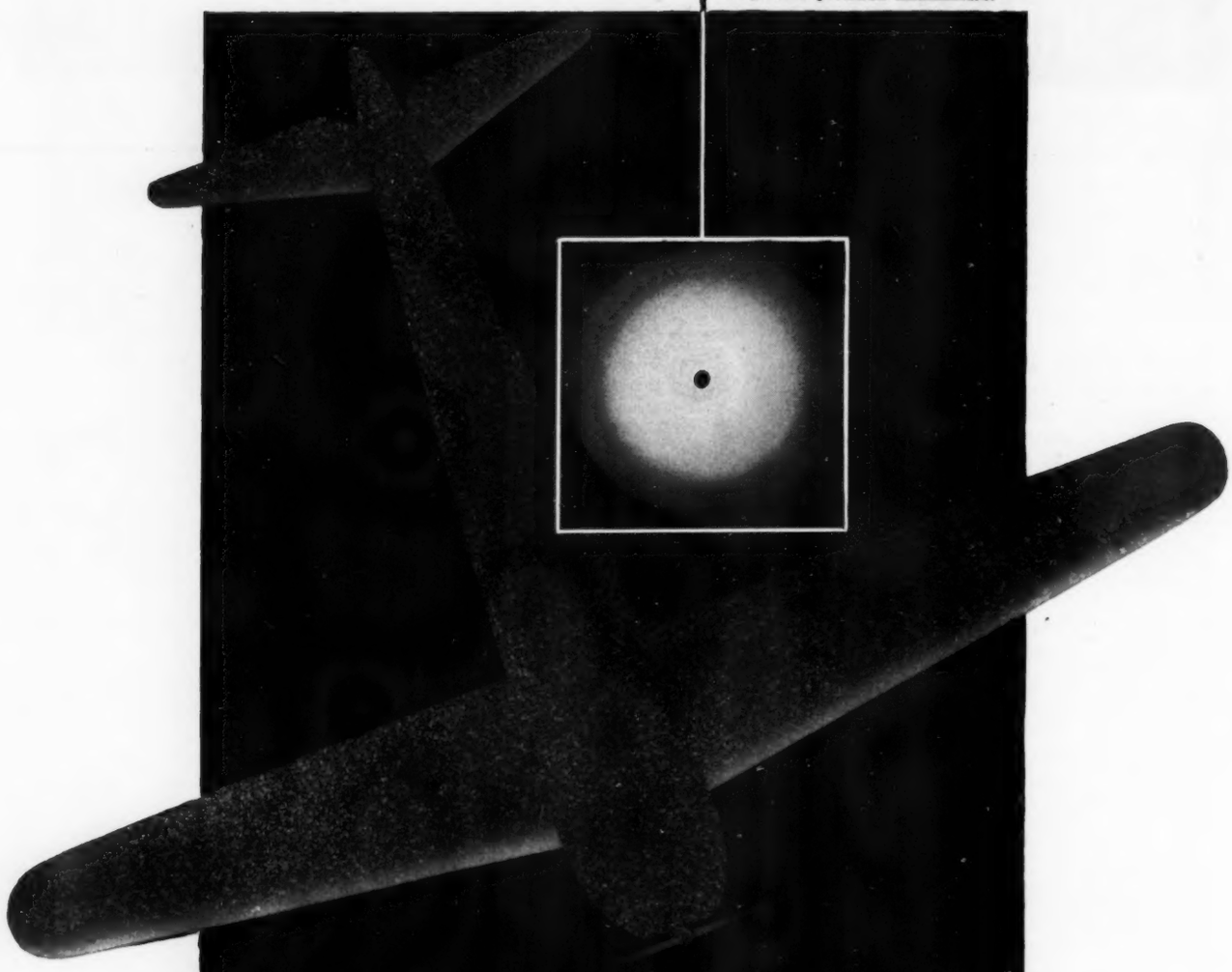

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Motion Economy

BY J. J. PHILLIPS

SHOPS can benefit by applying the principles of motion economy to plant layouts, tool design, training of machine and assembly operators, and materials handling. The following rules should aid the observer to improve considerably the average shop operations where no previous attempt has been made to apply formal motion study:

1. The workplace should be so arranged as to allow both hands of the operator to start and finish their work at the same time. The work should be apportioned between the two hands so that both will be busy substantially at the same time.

2. Motions of the arms should be made in opposite and symmetrical directions instead of the same direction, and should be made simultaneously. Symmetry of movement reduces fatigue and effort, and will result in rhythmic motion and greater speed.

3. Motions should be confined to lowest possible classifications in order to reduce fatigue, as listed below (lower to higher):

A. Finger motions.
B. Finger and wrist motions.
C. Finger, wrist and lower arm motions.
D. Finger, wrist, lower arm and upper arm motions.
E. Finger, wrist, lower arm, upper arm and body motions.

4. Hesitation should be analyzed and studied, its causes accounted for,and, if possible, eliminated.

5. Ascertain how the shortest time found in one part of a study was attained, and apply the reasons therefor so as to make such time a standard one.

6. Where delays occur, consider the possibility of providing some optional work that will permit using the time of delay, or account for it in some other manner.

7. Material and tools should be located, so far as possible, within the normal grasp area. This is a semi-circle in front of the operation.

8. Tools and materials should be located so as to be handy to the operator when needed during the operation.

9. Sequence of motions should be arranged so as to make performance of the operation as rythmic and automatic as possible.

10. Hands should be relieved of all work that can be done by the feet or other parts of the body.

11. Gravity feed containers should be used to deliver the material as close to the point of assembly or use as possible. This delivery point should be near the height at which it is assembled in order to eliminate any lifting or change in direction.

12. Use "drop delivery" whereby the operator may deliver the finished article by releasing it in the position in which it was completed, without moving to dispose of it.

13. Momentum should be employed to assist the operator wherever possible, and it should be reduced to a minimum if it must be overcome by physical effort.

14. Continuous curved motions involving rhythm should be used in preference to straight line motions involving sudden and sharp changes in direction.

15. Definite and fixed stations should be provided for all tools and materials enabling the operator to select and use them without taking his mind or eye off the principal part of the work.

16. Adequate lighting facilities should be provided for the operator. Illumination is the first requisite for satisfactory perception.

17. The height of the work place and the chair (where the operator can sit while working) should be so arranged as to allow alternate sitting and standing at work.

18. Two or more tools should be combined wherever possible to eliminate the handling of a number of tools where one can be employed.

19. Levers, crossbars and handwheels should be located in such positions that the operator can manipulate them with the least change in body position, and with the greatest mechanical advantage.

20. Provide the necessary jigs or fixtures to make it unnecessary for either hand to hold the work.

21. Avoid lost time due to the operator's having to pick up and lay down tools, either by having him carry tools in the hand continually, or by prepositioning tools so that a minimum of time is required in bringing them to the work.

22. Consider whether the work is being done on the machine best suited for the work and whether proper speeds and feeds are being used.

23. Determine whether or not another material, easier to machine, yet just as suitable for the job, can be substituted.

24. Supply bins and work place should be so arranged that parts may be moved into place without actually picking them up, that is, by sliding them into position.

25. Determine whether the entire operation or any element of the operation may be omitted entirely. Entire operations or elements are oftentimes done only because of habit.

26. Two or more pieces should be arranged in a fixture instead of one.

27. If there are more than one or two operators doing the same kind of work, select the best methods and motions of each and apply them to all.

28. Almost anything done to promote the comfort of the operator will tend to increase output and decrease fatigue.

The application of the foregoing principles is even more important on multiple machine jobs than on single machine operations. The cost of labor for processing parts on automatic machines goes down as the number of machines cared for by each operator is increased. The number of machines per operator, in turn, can be increased if the attention time per machine is decreased. For these reasons, any motion economy principles which will decrease our loading or unloading time should be given our earnest consideration.

CALL 'EM *RIGHT!*

If you find it difficult to describe a tap correctly, or if you are in any doubt about the exact meaning of certain terms, the definitions on this page may help you. Keep it for handy reference.

AXIS OF TAP: The longitudinal central line through the tap.

BODY: The threaded and fluted part of tap.

CHAMFER: The tapered outside diameter at the front end of the threaded section.

CUTTING FACE: The front part of the threaded section of the lands.

EXTERNAL (MALE) CENTER: Sometimes termed "male center." It is the cone shaped end of the tap. It is found only on small taps and is for manufacturing purposes. It is usually found only at the threaded end.

FLUTE: The groove providing for the cutting faces of the threads or teeth, for chip passage and for lubrication.

HEEL: The back part of the threaded section of the land.

HOOK: The curved undercut of the cutting face of the land.

INTERNAL (FEMALE) CENTER: Sometimes termed "female" center. It is the small drilled and countersunk hole at the ends of the tap, necessary for manufacturing purposes.

LAND: The threaded web between the flutes.

POINT DIAMETER: The outside diameter at the front end of the chamfered portion.

RADIAL: The straight cutting face of a land which, if continued, would pass through the center of the tap.

RAKE: The angle of the cutting face of the land in relation to a straight line from the point of the cutting face to the axis.

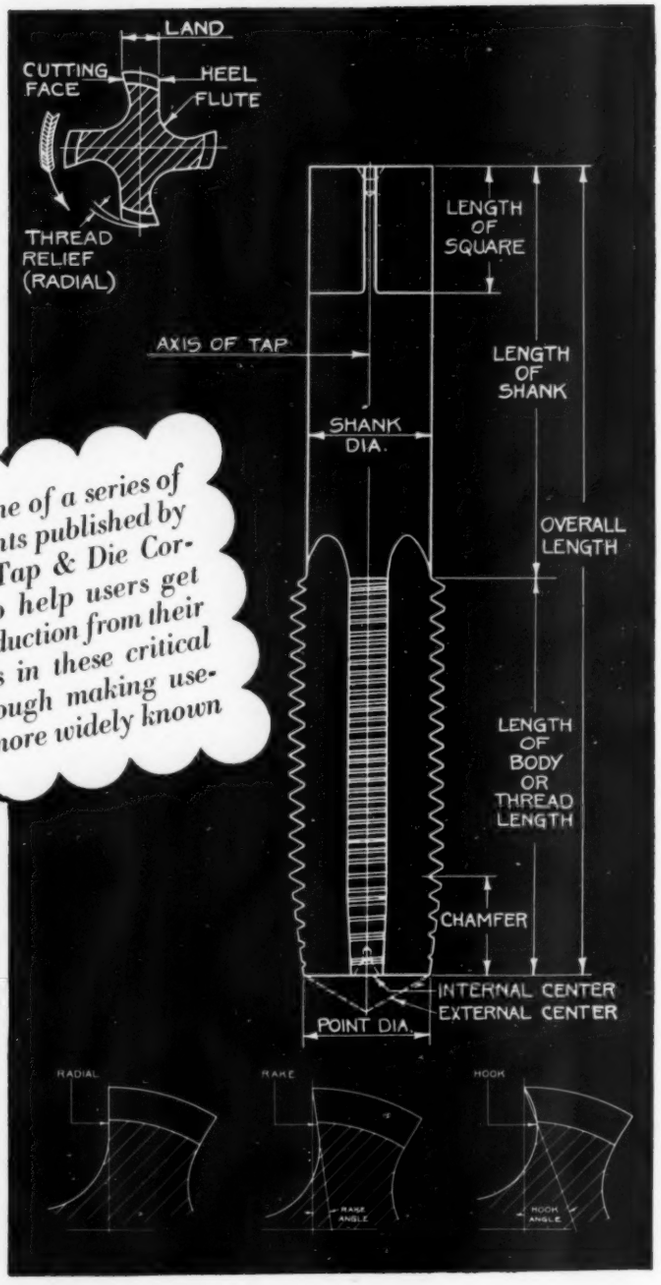
SHANK: The part behind threaded and fluted section of tap.

SQUARE: The squared end of the tap shank.

THREAD: The cutting tooth of the tap which produces the thread.

THREAD RELIEF (RADIAL): A clearance providing a gradual decline in the major, pitch and minor diameters of the lands, back of the cutting face. This style of relief is applied only to certain sizes and types of taps.

This is one of a series of advertisements published by Greenfield Tap & Die Corporation to help users get greater production from their small tools in these critical times, through making useful facts more widely known



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Time to Scrape and Save

LIKE IT OR NOT, an economy of scarcity is about to descend upon us. Most people don't yet realize it, because it hasn't hit most spots thus far. But signs are clear that it is approaching at lightning speed. And its effects on our way of doing things, at home and in the factory, may be as devastating as though a shattering bomb had been dropped from the skies.

Look around at the evidence. Gasoline rationing threatens. We are told about shortages in steel, copper, aluminum and a multitude of materials, shortages which are labeled "temporary," but which are sure to continue indefinitely. We won't be able to step into a store and buy almost anything we desire merely for the asking.

In fact, in many lines the situation is so serious that we must learn to scratch and save. Americans have been willing to put plenty of money in the savings banks, but they have been prodigal with materials. They haven't taken the trouble to reclaim or salvage goods which obviously have a further useful life. They have been wasteful.

Now we are up against it in a very real way. Unless our defense plans are to be retarded, unless we are to be made to pull in our belts even further than now seems necessary, we must acquire the saving habit. That habit must extend all the way from the housewife at home to the man at the machine in the metal-working shop.

Two examples come to mind of the sort of thing that we must do willingly. The steel industry is scraping the bottom of the barrel trying to find enough iron and steel scrap with which to keep operations at a top level (nine million tons of scrap have gone to Japan in recent years). The American Rolling Mill Co. has conducted campaigns in the cities where it has mills to get every citizen to brush every corner in an effort to turn up every possible pound of scrap. Says Armco, "We will find scrap iron and make it into bread and butter for Armco families and send it on its way to bolster the freedom of America."

Then there is the shortage of nickel. Heretofore many shops and many scrap dealers have not troubled to segregate nickel steel scrap from carbon steel scrap. The nickel steel scrap returns to the mills unidentified. Now OPM is asking industry to segregate the scrap according to the percentage of nickel content. The same general procedure applies to other alloy steels.

Some of the larger plants can readily and profitably segregate the scrap. The smaller shops will have more difficulty. The same machine will be used first to machine one metal and then another. The proper separation of the scrap will depend on the man at the machine. He must clean all the scrap out from one operation before he begins another using a different material.

This matter of saving gets into many corners of industry. The breakage and scrapping of cutting tools is alarmingly high and must be reduced by education of the machine operators, many of whom are green hands today. Cutting tools can be salvaged in many cases. Scrap can be shipped back to the mills promptly instead of being allowed to accumulate for months at a stretch.

Admittedly the idea of saving what previously has been wasted involves a turn-around in the thinking of many people. But it is a job that we must do, and there is no way out of it. The quicker we enter into the doing of it, the better. The householder must do his or her part. Industry also must do its part and, among other things, must see that the man in the shop becomes conscious of the importance of his contribution. This is the time to scrape and save not only for defense purposes, but to continue to maintain the standard of living to which we have become accustomed.

Burnham Finney

GAGING BUSINESS

Defense contractors may be asked to move ahead deliveries, thereby forcing more farming out of work. New tank program calls for an output of 1,000 units a month by next July 1

Priorities, shortages of materials and difficulties in switching over from non-defense to defense operations are of grave concern to the country's metal-working industry at the moment. In an attempt to secure higher production of armament, the government may ask prime defense contractors to move ahead their delivery dates. That would require the farming out of more work, a goal toward which defense officials have been pushing for months. Some method of compelling contractors on all subsequent defense awards to spread work fully seems certain. Whether there are enough materials available to permit much speed-up however, appears doubtful. So-called "temporary" shortages of materials are likely to continue indefinitely and, in fact, become more acute.

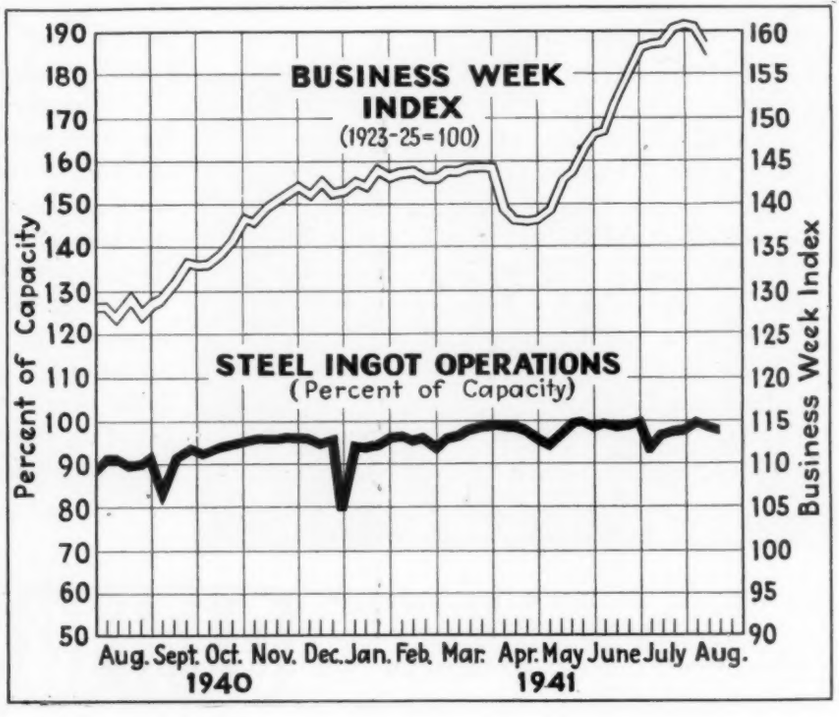
Railroad Equipment—With few outstanding inquiries, freight car orders will drop considerably this month. July bookings of 10,889 cars compares unfavorably with 29,300 in June. The decline reflects the influence of long delivery dates. The present program for completion of 100,000 cars by October is running 12,000 cars behind schedule because of materials shortages. The industry hopes to build 140,000 freight cars next year, more than doubling production of the last twelve months. August business in locomotives has been good.

Farm Equipment—Manufacturing volume is about 20 per cent ahead of last year. With the continued labor shortage on farms, the pressure for more mechanization is being steadily applied and the problem becomes one of whether lack of materials will slow down production. The recent ruling to allow farm equipment makers preference in steel allotments will be of temporary help. Most tractor builders have switched over from nickel to chrome molybdenum steels, one large company being the main exception.

Steel—Operations have been whittled down to around 97 per cent because insufficient scrap is available to keep open-hearths running to maximum capacity. Full priorities on steel, ordered by OPM, are welcomed to some extent by the industry which has been under heavy pressure from important non-defense customers, such as automobile makers, to deliver large tonnages. Responsibility for preferential treatment of customers now rests on the government. Plans are under way for expansion of steel capacity by 12,000,000 tons a year; the final figure may be as high as 15,000,000 tons.

Machine Tools—A new tank program has been launched which will need 3,000 to 4,000 machine tools, according to rough estimates. The use of thousands of tanks in the Nazi-Soviet war has convinced military authorities that U. S. tank output, partly for the British, should be stepped up sharply. Accordingly plans are in progress for production of M-3 (medium) tanks to be expanded to 1,000 a month by July 1, 1942. Present sources of supply will be employed—Chrysler, Baldwin and American Locomotive—and much work will be farmed out. Half or more of the machine-tool requirements for the big bomber program have been placed. Float orders totaling over $85,000,000 have been allotted machine-tool builders by the Defense Plant Corp. Two hundred million dollars is available for such purposes. The bomber program will take around 30,000 machine tools. Machine-tool builders, particularly the larger ones with as many as 10,000 machines on order, are experiencing difficulty in rearranging production schedules to conform to the new priorities set-up. In addition to new preferential list of deliveries arranged according to urgency, machine-tool companies are asked by OPM to make a considerable number of diversions of machines from one contractor to another. All of these rearrangements, plus trouble in getting materials for subcontractors as well as for themselves, have affected machine-tool builders to the extent that production has been somewhat retarded. Defense agencies are threatening to eliminate dealers' commissions on government orders for machine tools, though dealers are performing a valuable service in getting production started in defense contractors' plants.

Munitions—The clipping of $1,250,000,000 from the supplemental defense bill for the Army is not expected to make any perceptible difference in the rate of tank and gun production. If more capacity were at hand for manufacturing these products, the Administration would have secured the appropriation from Congress without effective opposition. By next January the Army will have over 1,000 medium tanks. Defense Plant Corp. has completed leasing agreements with sixteen companies for expansion of facilities for munitions and defense production. Included are $2,699,680 for new buildings and equipment for Champion Machine & Forging at Cleveland; $10,529,173 for Emerson Electric at St. Louis; $10,267,043 for plant expansion of Buick at Chicago and Flint, Mich.; and $8,456,175 for plant expansion of Bell Aircraft at Niagara Falls, N. Y. Rock Island, Ill., Arsenal will establish a $3,500,000 plant for manufacture of .30-caliber Browning machine guns.



Industrial Accidents Increase as Production Tempo Speeds; OPM Turns Hand to Problem

WASHINGTON—If some great accident should suddenly hit a city the size of Detroit, injuring or crippling every man, woman and child in that city of 1,500,000 poppulation—and in addition killing 16,000 people outright in a nearby town—everybody would recognize it as an appalling national calamity. Yet in 1939, that is the toll exacted from American workers by on-the-job accidents. More than 16,000 men and women killed and a million and a half persons seriously injured.

But 1939 was not an exceptional year. In 1940 accidents resulted in 17,000 deaths, 2,180,000 disabilities. A direct loss of 200,000,000 man-hours of production. This would be sufficient to build either 18,000 large bombers; 30,000 medium bombers; 75,000 to 90,000 fighter planes; 125,000 trainer planes; 450 submarines; 375 destroyers; or 45 battleships. Time lost due to injuries was four times greater than time lost by strikes in 1939; accident loss of manpower in 1940 is estimated more than 20 times that of strikes.

With industrial accidents increasing 20 per cent as a result of the expanded and speeded production for defense, the Office of Production Management will soon launch an organized safety program on U. S. contractors. Army and Navy already install a safety engineer in the plants of those manufacturers having prime contracts.

OPM's work will supplement that being done by the national committee for the Conservation of manpower in Defense Industries, various federal, state, and private safety agencies. The committee, a government body set up June 1940, serves on a voluntary basis and includes industrial safety engineers, labor representatives and state officials administering safety and health laws. Its field work is done by 400 safety engineers employed by industry, but lent to the government on a $1-a-year basis. Their services are free to all industrial plants.

The committee, which is a part of the Division of Labor Standards, U. S. Department of Labor, indicates that most accidents occur in small plants with subcontracts. More accidents occur on the "night" or third shift than on any other. Then, too, more accidents are being caused by the fact that there are no more skilled men to be had and manufacturers are being forced to hire and train totally unskilled men for machine work.

A recent analysis shows that 20 per cent of industrial accidents are chargeable wholly to correctable physical hazards. In 60 per cent of the cases the causes are traceable to both physical hazards and human faults. Thus in 80 per cent of industrial lost-time accidents a correctable physical hazard is either the sole or a joint cause. The most important physical hazards listed by the committee are: Fire and explosion; structures, equipment and maintenance; machine guarding; power and electrical; and handling transporting equipment. More importance should be attached to injuries resulting from the operation of machinery than to those from other sources because the former are usually serious.

Due to the speeded tempo of production in England and Canada, industrial accidents in those countries have increased more proportionately than has the rise in employment. The same thing is likely to happen in the U. S. It has been estimated by the Bureau of Labor Statistics that 6,859,000 defense workers will be employed by the end of the year. Out of this group will be 1,500,000 new workers. If the present rate of accidents continues, more than 100,000 of the total will be either temporarily or permanently disabled. About 20,000 will die.

LATEST DEFENSE CONTRACTS

WASHINGTON — Contracts awarded last week by the War Department include: Vultee Aircraft, Inc., Downey, Calif., $14,518,707, for aircraft; Beech Aircraft Corp., Wichita, Kan., $12,610,125 for aircraft; Diamond T Motor Co., Chicago, Ill., $10,096,769, for tank transporters; Yellow Truck & Coach Mfg. Corp., Detroit, Mich., $4,231,987, for trucks; National Supply Co., Ambridge, Pa., $5,093,130, for shell forgings; and Remington Arms Co., Inc., Bridgeport, Conn., for ammunition, $86,580,331.

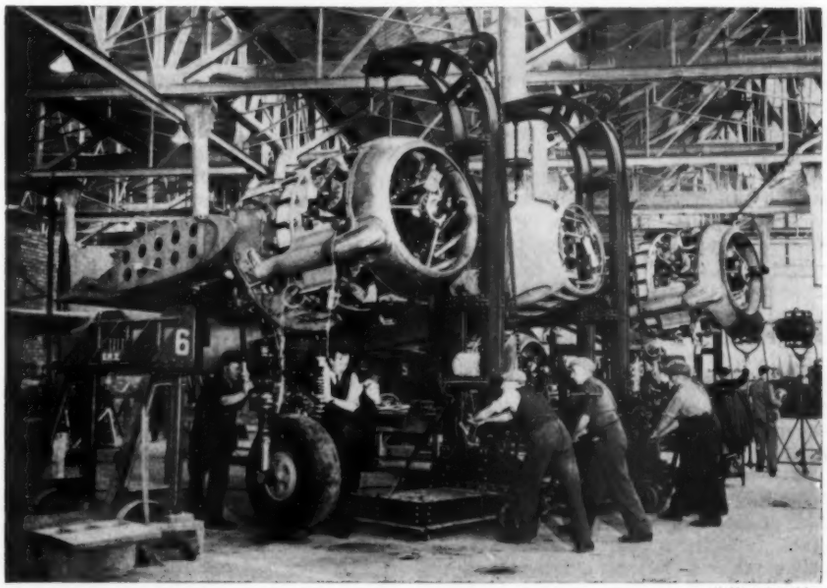
GRINDING WHEELS NOT UNDER PRIORITY CONTROL

WASHINGTON—Grinding wheels have not been subjected to any form of priority control. Current supplies, it is indicated by the priorities division, Office of Production Management, are ample. Users of grinding wheels may get deliveries without restriction. The report appearing in American Machinist, August 6, page 776c, indicating that grinding wheels had been placed under priority control is erroneous.

Copper on Full Priority; Zinc Expands; Tin Watched

WASHINGTON—A price ceiling of 12 cent a pound on copper slapped down by the Office of Price Administration and Civilian Supply was followed recently by a complete priority control of the red metal by the Office of Production Management. OPACS is carefully studying the situation in tin, zinc, and plastics. To obtain copper consumers must apply to the priorities division of OPM. Expansion of zinc smelter capacity may enable supply to keep pace with demand. July production of slab zinc reached a record 66,419 tons.

OPM is developing an expansion plan for aluminum fabricating facilities to supplement the recent program to produce 600,000,000 lbs. of virgin aluminum. Plants will be privately operated under lease arrangements. An early price ceiling is indicated for tin.



British Combine

Beaus for Nazis—*Nazi night bombers think the British "beaus" are the least lovable machine made. Designed for long range day and night service Bristol Beaufighters played an important part in winning the "Battle of Britain." Soon this partly finished machine will do its bit*

Henderson's Price Ceilings Hold Down Cost Of Metal Working Materials; Civil Use Cut

WASHINGTON—Number 15 in Leon Henderson's Office of Price Administration and Civilian Supply series of price ceilings, is the 12 cent top on copper, imposed as of August 12. On July 22, ceilings were placed on the principal kinds of brass mill scrap. And on July 28, Mr. Henderson announced that recent increases in tin, stimulated by uncertainties in the Far East, may force him to put a ceiling on tin in the near future. Nine of the total 15 ceilings thus far are on materials of the metal-working industry: used machine tools, aluminum scrap, zinc scrap, scrap iron and steel, steel, secondary materials containing nickel, pig iron, brass mill scrap, and copper.

You may be confused when you recall that copper has been under a 12 cent price ceiling all along. But this ceiling was not official; it was merely an agreement. The object in putting on the official ceiling was to permit OPACS to make upward adjustments in favor of high-cost producers, which will increase the copper output. Though OPACS is sidestepping a run-away on copper as on everything else, price, actually, is of no consideration on this vital material, if it is justified by cost of production.

Brass, Scrap Top Is 9½ Cents

Regarding brass mill scrap, Henderson said that the defense program increased the demand so that dislocations and instability made it impossible in some cases for the trade to cooperate with the Government in maintaining prices. Top prices fixed for heavy scrap range between 9½ cents per pound for commercial bronze containing 95 per cent or more copper and 8⅝ cents per pound for yellow brass. Premiums are allowed for lot shipments. Both the copper and brass ceiling schedules have general terms similar to those of previous schedules.

While the metal-working industry was adjusting itself to additional price controls on its materials, President Roosevelt got set for a move that will greatly cut down civilian demand for these materials. He ordered the Federal Reserve System to "investigate, regulate and prohibit" installment buying and installment loans. The order will cut deeply into the demand for durable goods such as cars, washing machines, refrigerators, home laundry equipment, vacuum cleaners and other items.

This move is intended to divert the essential metals from civil to defense use, to conserve individual incomes for taxes, to prevent inflation and to build up a post-war demand of consumer goods. Production has increased 50 to 55 per cent since outbreak of the European war; the general price level has increased 20 per cent; American payrolls now is at 152 per cent of "normal."

It may seem strange that the President, by a few strokes of his pen, can order this vast curtailment of the Nation's $7,000,000,000 annual easy-payment business. It's this way. All credit paper is backed by banks. The Federal Reserve System simply says that certain kinds of paper are not acceptable. An economist could write a book on it, but that's what he would say. Persons whose credit is really good can still go to their banks and borrow money and buy whatever they want. But the great bulk of goods is bought by poor folks who pay through the nose.

The Administration's price control bill in Congress, which mainly provides weapons for enforcing the present piece-by-piece system, is confronted by three obstacles. One was a demand in Congress for curb on installment buying. The President will have fixed that when the Federal Reserve program goes into effect. The other two are agricultural prices and wages. Those are hot potatoes. The bill will be passed in a form to give the farmers parity or better and, as Mr. Henderson puts it, to keep wages reasonable "in the light of living costs."

Priorities Division of OPM Opens 3 New Field Offices

WASHINGTON—New field offices of the priorities division of the Office of Production Management are being opened at Los Angeles, Seattle and Kansas City. The latter will be a branch of the St. Louis office and it will be directed by Clifford H. Carr, assistant district manager.

The Seattle office will be in the Stuart building with William D. Shannon, for many years northwest manager of Stone & Webster Engineering Corp., district manager. G. Howard Hutchins, for five years president of the Filtrol Company of California and since 1937 associated with the Clayton Manufacturing Co., has been named district manager of the Los Angeles office, which will be located at 1151 South Broadway.

PROPERTY DRAFT IMMINENT

WASHINGTON—The "Draft Property" bill, passed by both houses of Congress, has been agreed upon by a House-Senate conference committee, and at this writing was being brought before the House for approval. From the House it goes to the Senate, then to the President for signature. Detail of changes by the conference committee were not known, but in general the bill authorizes the President to take possession of any equipment or materials urgently needed for defense, and pay for them.

Congressmen Are Concerned Over Plight of Small Firms

WASHINGTON—The small manufacturers' problem is getting hot, and it could grow into a major political issue. Most of the country's goods normally are produced by small firms, yet now a few big ones have the bulk of war orders. Not only do the little fellows resent the present pinch amid plenty, but they and many social-minded congressmen are worried about the future. It looks to them as if the big few manufacturers will turn out to be even bigger and maybe fewer after the war.

The War Department and defense agencies, occupied as they are with economics and technical matters, are accused of having failed to see this political shadow, as big as a mountain. They have made surveys of small plants but the owners complain that nothing much has been done.

War Department announced the other day it has completed surveys in quest of 500 additional consumer durable goods plants in the middlewest which can be converted to defense production. Undersecretary of War Patterson said he was trying to determine what plants facing a potential shutdown through rationing of raw materials can be converted to armament work.

Charge Moguls Want All Profits

Harsh charges are being placed against the moguls that they are not subcontracting because they want the profit from the complete job for themselves. But Service and defense officials are convinced now that these big producers must forget profit and distribute their technical and managerial ability among more workers through subcontracting. No one is asking them to turn over whole units to subcontractors who might learn the business and muscle in. The subcontractors, generally speaking, are to get only parts and subassemblies.

There is no longer any excuse, friends of small business say, for not subcontracting. Although some manufacturers say subcontracting is a headache, many others, the Sperry Corp. for example, and numerous machine tool builders, have made an outstanding success of it.

Some observers in Washington would not be surprised if pressure on the Services and OPM resulted soon in an official move to check on who can subcontract and who cannot.

House Minority Leader Joe Martin has just set up a committee to look into the present and post-war plight of the small manufacturer. He says that firms employing less than 200 workers comprise 99 per cent of all business and handle 65 per cent of the country's commerce. These firms, he says, are being strangled by priorities—meaning they have no defense work and they can't get materials to make civilian goods.

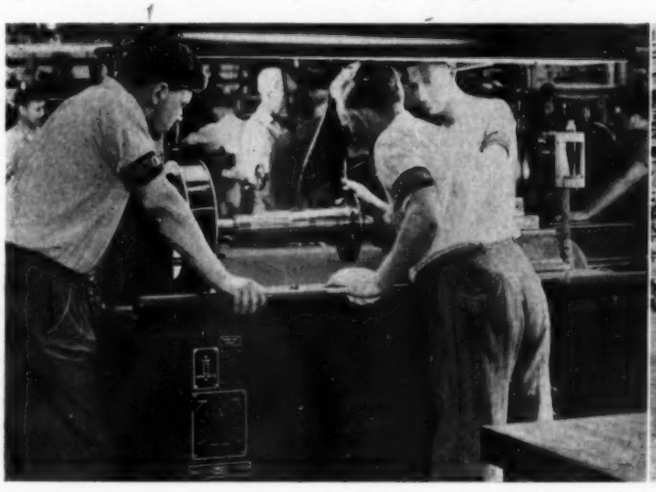
Packard's Plants for Rolls-Royce Engines Completed in 40 Weeks

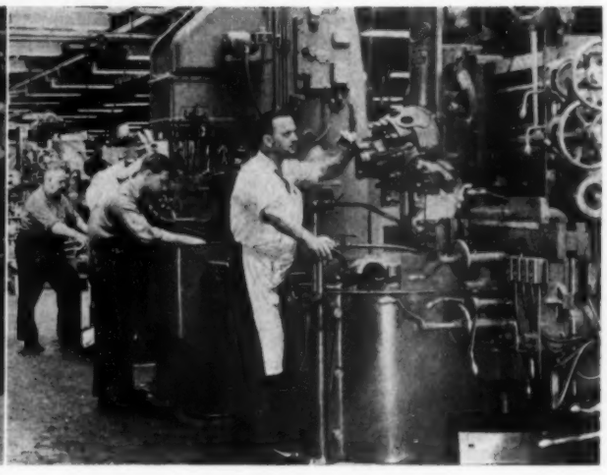
Dedication Ceremonies *held in Detroit August 2 marked the completion, in 40 weeks, of three factories in which Packard will build 9,000 Rolls-Royce Merlin XX fighter engines, 6,000 of which will be used by Britain, 3,000 in a U. S. Army fighter ship*

Aluminum Castings *for Rolls-Royce engines are thoroughly cleaned before machining. A powerful suction exhausts the dust from the cleaning booths (at top) and the air is cleaned by passing it through water*

Bearing Blocks *of the forked connecting rods carrying the bearings on which the blade connecting rods rotate are machined and finished (at right). The finish is so fine that each is protected from damage in a separate container*

The Propeller Shaft *of the engine (below at left) is electrically magnetized and later a liquid containing iron filings is poured over it. The patterns formed by the filings uncovers defects in the metal. Below at right workers are machining the super-charger casings*





U. S. Will Make 18,000 to 20,000 Airplanes In 1941 As OPM Speeds Production Program

WASHINGTON — Aircraft production schedules must be speeded up. At any rate the Office of Production Management has revised its production schedule for this year. For July 1,460 airplanes were produced, which is approximately equal to that for June when 1,476 units, more than in any previous month on record, were delivered. In July last year deliveries totaled 577.

Since April, when deliveries increased by more than 200 units to cross the 1,400 mark for the first time, production has held fairly steady. Starting with August deliveries must expand at the rate of approximately 250 units per month in order to meet the latest OPM schedule, which is understood to call for an output of about 2,000 units in September and of better than 2,700 in December. This speed-up would bring total production for the year within the 18,000 to 20,000 estimate made in official quarters. Production of 1940 would be tripled, and 1939 production would be bettered about 700 per cent.

OPM Sets Difficult Goal

The goal set by the OPM is even more difficult of accomplishment than the base figures indicate as the expansion will have to be attained principally on combat ships. Last month more than 55 per cent of the total production is estimated to have consisted of trainer types. By December, combat ships are scheduled to be accounting for close to 60 percent of all production.

To date the industry has been devoting the major part of its activities to tooling up for mass production. New facilities, constructed during the past year, are now coming into production and should begin to be reflected in monthly output figures. A further sharp upturn in output should develop as still newer plants, principally the large assembly plants to be supplied with parts and sub-assemblies by the automobile industry, come into use in early 1942.

The aircraft industry now has ample business on its books. Available figures indicate that roughly 65,000 airplanes are on order for delivery to the Army, Navy, and the British. What this means to the industry can be appreciated from the fact that in the year ended July 1 its total deliveries were less than 12,000 units.

The most recent revision in the production schedule was necessitated by the heavy-bomber program which calls for the output of 500 four-engined bombers per month. This goal, on the basis of present plans, cannot be reached until early 1943. The output of these large bombers probably will rise relatively slowly during the balance of the year until reaching about 100 monthly after which it should expand rapidly.

By the second half of 1942 U. S. plane production will be at the rate of 3,000 units per month, said Director General William S. Knudsen of OPM, following an inspection of western aircraft plants. For the full year, he predicted, that this country would produce 50 per cent more military planes than any other country.

Wave of Labor Trouble Plagues Defense Program

WASHINGTON—Just as the Defense Mediation Board passed its first week, after four and a half months of existence, with no strikes or lockouts on its slate, an impressive number of defense labor stoppages broke loose. All this came on the heels of a thumping vote by the House against the Connally amendment to the Selective Service Act authorizing the President to seize struck plants with military power. Regarded as most serious in the defense program, were the Mack Truck Co.'s Allentown, Pa., plant; and Federal Shipbuilding Co.'s Kearney, N. J., yard, which was about to be taken over by the Navy as this was written.

Meanwhile, Leon Henderson, OPACS Administrator, said that further demands for wage increases can be expected by the first of the year to meet rising living costs unless Congress quickly enacts legislation to place a ceiling on such costs.

OPM labor head Sidney Hillman announced that Gulf Shipbuilding and Repair Zone Standards Agreement had been ratified by AFL and CIO groups.

Object of the President's order suspending the 8-hour day for workmen on Army projects is to give the War Department a free hand in pushing rush work to completion and also to overcome labor shortages. Workers will be paid time and a half for overtime. The law prohibiting more than eight hours' work a day on Army, Navy and Coast Guard contracts was formally suspended by Congress in June 1940, for the duration of the national emergency.

OPM and OPACS Divided Authority is Confusing

WASHINGTON—The divided authority which exists between the Office of Production Management and the Office of Price Administration and Civilian Supply has been confusing industry in search of raw materials of late. The OPACS does not "order into effect" but merely "announces" allocations of non-defense goods. Priority status can only be given by an order issued by the OPM. Many manufacturers have received the impression that an OPACS program assured them the supplies they needed to turn out non-defense goods. As soon as a program was announced, applications for priority ratings came rolling in. However, they were not eligible for ratings until OPM acted.

OPACS still needs legal reinforcement for its activities in the field of civilian goods allocation. Getting price control legislation through Congress will be only half a loaf. What it wants is an executive order from Roosevelt delegating power to it. However the OPM division of priorities is also seeking an executive order which would lodge all priority powers with it. If its proposal is given Presidential blessing, it will not be obliged to share its power with OPACS.

PLANT EXPANSIONS SOAR

WASHINGTON — New industrial plants and expansions to existing ones authorized since the beginning of the defense program have reached a total of 2,082, it is estimated by government statisticians, and their cost will aggregate $3,549,770,000. To date the government is committed to plant financing totaling $2,720,936,000; private financing will amount to $828,834,000. For the most part financing done by private sources has been limited to the smaller projects.

Buffalo Program Absorbs 3,600 Displaced Workers

WASHINGTON—Machinery set up through government, management and labor cooperation for reemployment and training of 3,600 displaced automobile workers in the Buffalo area should serve as a national model in overcoming unemployment created by shutdown of non-defense plants. Acting Director-General Sidney Hillman of OPM reports that four big defense plants in this area agreed to employ at once 500 workers who lost their jobs when the North Tonawanda Chevrolet plant closed down for retooling. The plant will reopen in several months as an airplane engine factory. Eight hundred others have already been rehired, and 225 more are being retrained.

The Buffalo problem was typical in several respects of the many labor dislocations expected in the coming months from conversion of non-defense plants and from the operation of defense priorities, depriving factories of essential materials. Hence the pattern worked out for the Buffalo workers may be considered as a "pilot" which should be helpful in meeting similar situations elsewhere.

Arthur S. Flemming, chief of OPM labor supply branch, reports that the retraining period averages from three to five weeks, that the Buffalo plants have signified willingness to hire all workers qualified by retraining and that each trainee will receive $15 weekly unemployment compensation during the training period.

INSIDE DETROIT

Automobile industry, unsurprised by steel priorities, expects to get full share of non-defense steel. Production slash will be less than the 50 per cent suggested by OPACS but will be above 20 per cent

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—OPM's action in placing all forms of steel under full government priority control, effective Sept. 1, caused no surprise in the Motor Capital. For months, the automobile industry has put up a superhuman battle to get enough material to maintain production schedules. But the situation has steadily worsened. A sidelight on the present scarcity of steel for non-defense purposes is the week's delay experienced by Nash in starting up 1942-model assemblies through lack of steel.

Local sources state that the major steel companies have been shipping at least 50 per cent of tonnage for defense purposes. This ratio is far in excess of early expectations, when it was believed that one-quarter of capacity output would be sufficient for defense needs.

Under previous looser forms of priorities control, the steel companies could not estimate accurately defense and non-defense requirements. Orders for defense material might be padded with non-defense steel. Strictly non-defense orders might be in excess of immediate requirements, with the result that other customers suffered. These faults are to be corrected by the new system, under which purchase orders as of Sept. 1 must be accompanied by a special form setting forth the purposes for which the material will be used. Defense orders must be accepted by the steel companies, even if it means deferment of non-defense orders already on the books. Rationing of the remaining supply, inadequate for civilian needs under a "business as usual" policy, is likely to come later through a priorities numbering system. Judging from past experience, the auto industry will get its full share of what steel remains for non-defense purposes.

Pig iron, as well as steel, has been placed under full priorities control. In the opinion of steel company executives, priorities will create confusion for about a month. Analysis of the special forms accompanying purchase orders however, will permit accurate estimates of the amounts of these two materials available for non-defense purposes.

What effect full priorities on steel and pig iron will have upon curtailment of automobile production is unpredictable until the system has had time to gather full data on the materials outlook. Meanwhile, OPM was expected to rush through last week a decision concerning the additional production slash deemed necessary for the fall months. A high authority offered the opinion that the new degree of curtailment will exceed the original 20 per cent but be considerably less than the 50 per cent cut advocated by office of Price Administration and Civilian Supply. OPM's survey of the rate at which auto workers can be transferred to defense is said to have established that the figures published recently (*AM*—Vol. 85, page 776g) can not be substantially exceeded in the next few months. The materials supply is expected to get progressively worse, and in consequence another cut may be made by early winter. In other words, the outlook still favors a sliding scale of curtailment to fit the situation as it changes.

Steel and pig iron have no substitutes in motor-car manufacture, but restrictions upon their consumption are only part of the problem confronting auto company purchasing departments. Priorities on materials in general are so widespread, and the situation changes so rapidly that it is impossible to guarantee production forecasts at the present time. One of the major companies has set up a figure, but an executive stated that it could easily be upset by the lack of even one or two items. Production during August is a comparatively minor matter, and plants will be getting into stride in September. After that month the pinch in materials is likely to be felt.

Forward buying of steel has depended largely upon the attitude of the individual company and perhaps its cash position. Orders in some instances have been placed through Novem-

DEFENSE SHOPPING LIST

WASHINGTON—A shopping list of defense business on which automobile companies are invited to bid has been compiled by the Army. Urged by OPM, this action was one way of helping auto firms hasten the changeover from non-defense to defense operations. Chief complaint of some automotive companies is that choice business yet to be placed by the Army is not on the list because the Army knows where it wants to buy certain items and doesn't want its plans upset. The so-called "cats and dogs" are on the shopping list.

Test Training—*Each of the 10,000 Pratt & Whitney engines, which the Ford Motor Co. will build at its new $27,000,000 River Rouge plant, must be tested before release for use in military aircraft. Already Ford's apprentice school is training students to operate this maze of test house apparatus*

ber, with the implication at least that some plants will operate initially at only 20-25 per cent off the spring rate. But many changes in specification are still coming through for alloy steels. In deep-drawing material it is impossible to store steel for long periods without deterioration. Much steel has been fabricated into parts through unseasonably long operation of the parts industry. On the whole, reports indicate that materials banks are out of balance.

Delays in receipt of special tools needed for mass production automotive machinery may cause as much trouble in maintaining production schedules as lack of materials. A recent OPM order directs that all orders for special cutting tools be reviewed by that authority to determine their priority status. The ability of personnel associated with OPM is held in high regard by the auto industry, but it is questioned whether a long range decision can be made without intimate knowledge of the importance of special cutting tools in manufacturing.

Ponder Effect of Credit Control

It is a question as to what effect the President's credit control order will have on production of automobiles. In the first place, the forms of the controls are still vague. In the second, the actual number of cars that can be built is unknown. If production is curtailed sufficiently, there still may be enough customers able to meet the stiffer credit terms. Recently an auto company sales executive remarked that the "average deal" had been made with a 25 per cent down payment and eighteen months credit given on the balance. Any marked change in financing, he said, could have a more serious effect upon output than the original 20 per cent curtailment plan. While the announced purpose of the credit control order is to conserve materials in consumer goods lines and to curb inflationary tendencies, the suspicion exists that it is also designed to make the people more conscious of the fact that "there is a war."

HOLD SUBCONTRACTING SHOW

WASHINGTON—A forerunner of how defense production will be speeded is the subcontracting show being conducted by Continental Motors in Detroit. Now making two Wright Engines for tanks per day, Continental is to increase production to 30 and, the government hopes to 60 per day. Only way to achieve this goal is to farm out work. So Continental invited auto makers to look over engine parts and bid on them. This week other manufacturers are getting a crack at bidding. Besides speeding tank production, the plan will give much needed defense business to automobile companies.

British Combine

Little Men of War—*Playing an ever increasing part in war on the sea are many types of small craft. Canada is at work building nearly 1,000 ships ranging from assault to speedy torpedo boats at a cost of $8,000,000. In the corner of this Montreal plant hulls are being shaped for defense*

Canada's Aircraft, Explosives Production Increases; Autos are Curtailed 66 Per Cent

MONTREAL—Canada contracted for the construction of more than 1,000 planes injecting $25,000,000 into the arms of the aircraft industry. Some of these planes will be shipped to the U. S. Canadian Car & Foundry has received an order for 400 Hurricane fighters on which construction will begin soon. Noorduyn Aviation, Ltd., Montreal, received a contract for 500 Harvard trainers. National Steel Car Corp., Hamilton, Ont., will construct 200 Martin B-26 bombers, while Canadian Vickers, Ltd., Montreal, will build 39 PBY Airframes.

Canadian auto production in 1942 will be cut to "less than half" the 1940 production figure. The government has ordered an arbitrary reduction to about 44 per cent of the 1940 figure, a further reduction may be ordered later. Canadian auto production in 1940 was 110,126 passenger cars. Reduction in output of heavy and light delivery trucks is also planned in order to conserve steel and machine tools. Manufacturers have voluntarily undertaken to reduce the number of models of passenger cars offered to the public next year to 79 from 147 offered last year.

Of a total of 23 new chemical and explosives projects in Canada, 16 plants are now in production, six are scheduled to start this fall, while the balance will begin later. Three months ago only eight of the 19 projects were in production. Building of explosives plants is now virtually completed. The number of employees has increased from 4,000 to 11,000 in three months.

The Industrial Relations Dispute Investigation Act, applied to labor disputes in essential industries during peacetime, was extended to apply to all plants engaged on war work and continues to be the most potent instrument for averting strike tie-ups. Under this act, wage or other labor disputes must be referred to a conciliation board for settlement before a strike may legllay be called. If a strike is called "illegally," the participants are liable to heavy fines, leaders are liable to internment. In the 33 years of the act's existence, 978 applications were received for setting up of conciliation boards, 394 boards were appointed and in all but 41 cases (about 4 per cent) strikes or lockouts were averted or ended. In 1940, 66 applications were received, 33 boards established, while only three situations resulted in strikes. In 1941, to date, there have been 95 applications, 41 boards established, and only five resulted in strikes after board decisions.

Recent government contracts let through the Department of Munitions and Supply include:

Aircraft: Canadian Pratt & Whitney Aircraft, Longueuil, Ont., $4,631,813, and Fleet Aircraft Ltd., Fort Erie, Ont., $133,400. Shipbuilding: Yarrows Ltd., Victoria, $7,440,000. Munitions: Canadian Acme Screw & Gear Ltd., Toronto, $754,000; Chatham Malleable & Steel Products Ltd., Chatham, Ont., $149,232; Mueller Ltd., Sarnia, Ont., $234,838; and Engineering Products of Canada, Ltd., Montreal, $342,134.

WATCHING WASHINGTON

Steel for defense put completely ahead of civil needs by priority ruling. Army will use substitutes for vital materials in garrison equipment. Line production speeds Airacobras. Russia pays for aid.

By BLAINE STUBBLEFIELD

WASHINGTON—Steel in all forms, including alloy steel, was placed under full priority control August 10, by the priorities division of OPM. Defense needs, now using 25 to 35 per cent of total output, will be put uncompromisingly ahead of civil needs. While alloy steels are included under the present order, a separate order is to be issued shortly, giving details of the regulations applying to alloys. American steel production for 1941 is estimated at 87,000,000 tons of ingots. The difficulty is that 60 to 70 per cent of some steel products, such as steel plate, is required by defense.

Previously iron and steel products had been placed on the Priorities Critical List (giving Army-Navy orders priority), have been subject to inventory control, and have also been subject to the terms of the General Steel Preference Delivery Order No. 1, designed to expedite delivery of defense steel. An order putting pig iron under full control had been previously issued August 6.

Since iron and steel are now fully covered by specific priority regulations, they are being removed from the terms of General Metals Order No. 1, which provided inventory control. The General Steel Preference Delivery Order No. 1 is revoked.

A basic provision of the new steel order is that all defense orders must be filled ahead of non-defense orders. In connection with this, it is stipulated that defense orders must be accepted by steel companies, subject to certain exceptions, even if this acceptance means the deferment of non-defense orders or orders bearing lower ratings already on the books.

Other basic provisions of the steel order are: Steel as defined in the order means "all carbon and alloy steel castings, ingots, blooms, slabs, billets, forgings, and all other semi-finished and finished rolled or drawn carbon and alloy steels."

Defense orders include contracts or orders for the Army and Navy, for certain other government agencies, for Great Britain or any other lend-lease country, or any order to which a preference rating of A-10 or higher is assigned. Russia is not yet on the lend-lease list, but is getting priority, even over Britain in some cases, and paying cash.

In order to provide additional scrap iron for defense needs, a campaign to increase the junking of worn out automobiles was carried out through New England last week. The undertaking is part of a campaign to increase by at least 1,000,000 tons yearly the amount of scrap iron and steel by scrapping old cars, which on the average produce 1,500 pounds. OPM officials estimate that 30,000,000 tons of scrap iron and steel will be needed this year to keep our annual steel output at the rate of between eighty and ninety million tons.

A $23,000,000 government financed expansion program by the Bethlehem Steel Co. at its Sparrows Point, Md. plant has been recommended by OPM. The program calls for the construction of a 780,000 ton high speed 132-in. continuous plate mill and open hearth furnace with an annual capacity of 180,000 tons. The Bethlehem project is the third recommended by OPM in its program to expand capacity of the steel industry. Previous recommendations covered expansions of armor plate and heavy forging capacity of the Carnegie-Illinois Steel Corp. and an initial expansion of 6,508,950 tons in the industry's annual pig iron capacity. Meanwhile, last week steel operations declined to 97½ per cent capacity.

Army Pushes Substitute Materials

Some weeks ago the Army was getting ribbed for having aluminum coffee pots, knife handles, and other widgets. But today it's different. Quartermaster General Edmund B. Gregory says that wood and concrete are replacing steel. Aluminum is being saved by substitute materials in a variety of items from chairs to handles on field knives. The list of items in which copper is being eliminated "reads like a manufacturer's directory." He points out that substitution is difficult. For example, any change in steels, which are based upon nickel, chromium, manganese, vanadium, would upset automotive production. Changes must be viewed with caution. Nevertheless, specifications for motor vehicles are being revised. No purchases of garrison equipment containing aluminum are being made. The Army conservation program affects virtually every commodity in some way. Step by step, the Army is diverting small and large items of vital materials which add up to a stream for airplanes, tanks, and other weapons.

CUT MATERIALS FOR AUTOS

WASHINGTON—Defense officials are expected momentarily to demand that automobile and truck manufacturers eliminate from their 1942 models non-essential parts using metals in which shortages are worst. OPM learned that some auto companies have been able to add to their stock piles and, in the words of an OPM official, "this does not provide an incentive to conserve materials, especially aluminum." Meanwhile late last week the steel industry submitted proposals providing for the addition of more than 12 million tons to the country's annual ingot steel capacity. Further proposals are expected.

Approve Shipbuilding Contracts

The Maritime Commission has approved of negotiated contracts for construction of 45 single-screw "coaster" cargo vessels. Companies with whom the negotiated contracts will be made are: Lake Superior Shipbuilding; Leatham Smith Coal and Shipbuilding; Odenback Shipbuilding; Basalt Rock Co.; Pacific Bridge Co. Each contract will be made on the basis of construction of nine ships at an average price of $950,000 apiece.

Airacobra's Speed Amazing

Speed of production of the Army P-39 (Airacobra) fighter by Bell Aircraft has amazed defense officials and technicians who have seen it recently. Publication of actual figures is not allowed. Airplane production is now approaching actual "line" procedure, regarded as improbable not so long ago. Bell's new 240,000 sq. ft. plant at Niagara Falls will have two assembly lines with dolly cradles (carrying the plane in its later stages) moving at ⅝" per minute. This plant, for assembly only, is turning out P-39s for the Army. The Buffalo plant will continue to produce the P-39.

Russia Pays Cash

Russia is not getting aid under the lend-lease bill but is purchasing all of her supplies, according to the office of Harry Hopkins, lend-lease administrator. The question arose when transfer of four American oil tankers from duty along the West Coast to transportation of aviation gas to Russia. These tankers are still under American registration and each transports from 135,000 to 140,000 barrels.

U. S. Government Contracts Awarded to Metal-Working Firms

(Does not include contracts under $150,000)

Source	Agency	Commodity	Amount
Barlow & Seelig Co., Ripon, Wis	War	Shell	$339,765
Riverside Metal Co., Riverside, N. J.	"	Cartridge disks	507,017
Continental Motors Corp., Muskegon, Mich	"	Engines	3,921,651
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.	"	Small arms material	1,056,585
Kelsey-Hayes Wheel Co., Plymouth, Mich	"	" " "	24,334,286
Vilter Mfg. Co., Milwaukee, Wis	"	Guns	1,446,518
Pettibone Mulliken Co., Chicago, Ill	"	Gun carriages	1,846,000
Firestone Tire & Rubber Co., Akron, Ohio	"	"	56,883,840
Singer Mfg. Co., New York, N. Y	"	Directors	3,432,000
Continental Roll & Steel Fdry. Co., East Chicago, Ind	"	Castings	3,252,000
Buckeye Traction Ditcher Co., Findlay, Ohio	"	Transmissions	2,348,000
General Motors Corp. Detroit, Mich	"	Diesel engines	1,137,800
General Steel Castings Corp., Eddystone, Pa	"	Castings	3,450,000
American Locomotive Co., New York, N. Y	"	Tank parts	1,417,590
Bucyrus-Erie Co., South Milwaukee, Wis	"	Gun carriages	2,807,900
Trackson Co., Milwaukee, Wis	"	Truck mounts	942,114
American Car & Foundry Co., Berwick, Pa	"	Tanks	1,787,337
Chrysler Corp., Detroit, Mich	"	"	74,567,761
Diamond T Motor Car Co., Chicago, Ill	"	Carriers	4,498,706
Guiberson Diesel Engine Co., Dallas, Texas	"	Engines	1,049,656
International Harvester Co., Chicago, Ill	"	Tractors	2,126,899
Oilgear Co., Milwaukee, Wis	"	Tank parts	2,105,469
White Motor Co., Cleveland, Ohio	"	Cars	5,476,926
Mack Mfg. Corp., Long Island City, N. Y	"	Tank assemblies	6,419,481
American Car & Foundry Co., Berwick, Pa	"	Tanks	12,543,213
Autocar Co., Ardmore, Pa	"	Carriers	4,519,531
Ward La France Truck Corp., Elmira, N. Y	"	Trucks	1,658,519
Central Steel Tube Co., Inc., Clinton, Iowa	"	Mounts	746,502
Revere Copper & Brass, Inc., New York, N. Y	"	Brass cups	11,033,601
McCord Radiator & Mfg. Co., Detroit, Mich	"	Helmet bodies	3,215,370
H. W. Butterworth & Sons, Philadelphia, Pa	"	Mounts	3,003,000
Crown Cork & Seal Co., Baltimore, Md	"	"	2,713,926
American Car & Foundry Co., Berwick, Pa	"	Armor plate	1,090,000
National Stamping Co., Detroit, Mich	"	Belt links	1,037,275
Snap-On Tools Corp., Kenosha, Wis	"	Socket wrenches	366,573
J. H. Williams & Co., Buffalo, N. Y	"	" "	422,794
Yale & Towne Mfg. Co., Stamford, Conn	"	Pumps and motors	185,294
Air Associates, Bendix, N. J	"	Bolts	251,797
Reynolds Metals Co., Louisville, Ky	"	Aluminum	253,637
Pump Engineering Service Corp., Cleveland, Ohio	"	Pump assemblies	466,041
General Motors Corp., Indianapolis, Ind	"	Tools	272,293
Colson Corp., Elyria, Ohio	"	Cradle assemblies	232,010
Republic Drill & Tool Co., Chicago, Ill	"	Drills	147,568
Scovill Mfg. Co., Waterbury, Conn	"	Cups	449,525
Jacobs Aircraft Engine Co., Pottstown, Pa	"	Engines	6,006,577
Bendix Aviation Corp., Bendix, N. J	"	Starters	5,561,200
General Motors, New York, N. Y	"	Trucks	2,726,873
Yellow Truck and Coach Mfg. Co., Pontiac, Mich	"	Trucks	302,065
Fargo Motor Co., Detroit, Mich	"	"	418,366
International Harvester, Chicago, Ill	"	"	172,219
Willys Overland Co., Toledo, Ohio	"	"	13,411,864
Crosby Co., Buffalo, N. Y	"	Magazines	420,000
Cambridge Screw Co., Cambridge, Mass	"	Percussion primers	270,987
Oil Well Supply Co., Oil City, Pa	"	Shell	243,250
Midvale Co., Philadelphia, Pa	"	Tube forgings	334,436
Ex-Cell-O Corp., Detroit, Mich	"	Machines	483,025
Boeing Aircraft Co., Seattle, Wash	"	Aircraft parts	212,090
Weston Electrical Instrument Corp., Newark, N. J	"	" "	249,246
Van Norman Machine Tool Co., Springfield, Mass	"	Milling machines	744,100
Robertshaw Thermostat Co., Youngwood, Pa	"	Boosters	895,923
Automatic Machine Products Co., Attleboro, Mass	"	Primers	621,756
Stewart-Warner Corp., Chicago, Ill	"	Fuzes	1,884,923
Noblitt-Sparks, Inc., Greenwood, Ind	"	Casings	677,396
Auto Specialties Mfg. Co., St. Joseph, Mich	"	Shell	595,000
King-Seeley Corp., Ann Arbor, Mich	"	Fin assembly	553,932
Westinghouse Air Brake Co., Wilmerding, Pa	"	Boosters	544,000
Harrisburg Steel Corp., Harrisburg, Pa	"	Bombs	1,402,300
Pennsylvania Forge Corp., Philadelphia, Pa	"	Forgings	969,629
Struthers-Wells-Titusville Corp., Titusville, Pa	"	"	596,953
Crosley Corp., Cincinnati, Ohio	"	Shackle assemblies	729,995
Oneida Ltd., Oneida, N. Y	"	" "	546,158
Yellow Truck & Coach Mfg. Corp., Detroit, Mich	"	Trucks	4,281,987
Rogers Bros. Corp., Albion, Pa	"	Tank trailers	1,637,195
Winter-Weiss Co., Denver, Colo	"	Trailers	1,096,200
Diamond T Motor Co., Chicago, Ill	"	Tank transporters	10,096,769
Mack Mfg. Co., Long Island City, N. Y	"	Chassis	551,672
Framanco Co., Boston, Mass	"	Shells	545,670
Burgess Co., Inc., Beaver Falls, Pa	"	Shot	910,000
War Supplies, Ltd., Ottawa, Canada	"	Trainers	16,070,920
Rolls-Royce, Inc., Detroit, Mich	"	Bearings	772,287
Framanco Co., Framington, Mass	"	Metal shell parts	545,670
Cambridge Screw Co., Cambridge, Mass	"	Primer	270,987
Automatic Machine Products Co., Attleboro, Mass	"	"	621,756
Perfex Corp., Milwaukee, Wis	"	Mine fuze	350,000
Van Dorn Iron Works Co., Cleveland, Ohio	"	Armor plate	1,497,303
Addressograph-Multigraph Corp., Cleveland, Ohio	"	Fuze disk	355,500
United Engineering & Fdry. Co., Pittsburgh, Pa	"	Howitzer parts	203,008
Acme Die & Machine Co., Latrobe, Pa	"	Assembly primer	454,629
General Motors Corp., Anderson, Ind	"	Cartridge case	1,207,960
Pennsylvania Forge Corp., Philadelphia, Pa	"	Forgings	969,629
United Shoe Machinery Corp., Beverly, Mass	"	Guns	1,902,374
Mesta Machine Co., West Homestead, Pa	"	"	1,863,140
Cincinnati Milling Machine, Cincinnati, Ohio	Treas	Milling machines	297,528
Porter-McLeod Machine Tool Co., Inc., Hatfield, Mass	"	Lathes	315,600
Northrop Aircraft Inc., Hawthorne, Calif	War	Airplanes	16,287,134
Vultee Aircraft, Inc., Vultee Field, Calif	"	"	46,137,987
Douglas Aircraft Co., Inc., Santa Monica, Calif	"	"	10,587,192
Bell Aircraft Corp., Buffalo, N. Y	"	"	7,407,540
Nash-Kelvinator Corp., Detroit, Mich	"	Propellers	15,237,500
General Amer. Transportation Corp., Sharon, Pa	"	RR tank cars	1,287,000
Buckeye Traction Ditcher Co., Findlay, Ohio	"	Tank transmissions	2,348,000
General Motors Corp	Treas	Trucks	667,830
Trailer Co. of America, Cincinnati, Ohio	War	Semi-trailers	1,261,474
North American Aviation, Inc., Kansas City, Kan	"	Airplanes	126,540,000
Douglas Aircraft Co., Inc., Santa Monica, Calif	"	"	7,843,010
St. Louis Car Co., St. Louis, Mo	"	Ammunition car	744,600
Beech Aircraft Corp., Wichita, Kan	"	Aircraft	12,610,125

U. S. Awards $63,000,000 For Magnesium Plants

WASHINGTON — Basic Magnesium, Inc., Cleveland, has been awarded a $63,000,000 government contract for the building of plants to make metallic magnesium products needed for aircraft. The contract was awarded through the Defense Plant Corp. and the plants will be built at Mead, Gabbs, and Las Vegas, Nev. They will have a gross capacity of 56,000 tons of metallic magnesium a year. U. S. production of magnesium in 1940 is estimated at 6,000 tons. German production was 12,000 metric tons. The new plants will make the U. S. completely independent of foreign sources. The Defense Plant Corp. will retain title to the plants under a lease agreement. Magnesium, one-third lighter than aluminum, has been an obstacle to defense production.

NAMES in the NEWS

C. J. Abbott, formerly general manager, has been elected president, the Jacobs Aircraft Engine Co., Pottstown, Pa. He succeeds J. Story Smith, who becomes vice-president, secretary and treasurer.

Frank R. Burnette has been appointed assistant chief engineer, Carnegie-Illinois Steel Corp., Pittsburgh, Pa. He had been construction superintendent since November 1, 1939.

K. P. Crowell, factory training manager, Caterpillar Tractor Co., Peoria, Ill., has been appointed to the Training Within Industry branch, Office of Production Management, Washington, D. C. He is also chairman, the Advisory Committee of Defense Training in Peoria.

Arthur P. Emmert, works manager, Warner Gear Div., Borg-Warner Corp., Muncie, Ind., has been elected president, Warner Gear Div.

George B. Ewing, Jr., has been appointed to the staff of sales engineers, Houston office, The Foxboro Co., Foxboro, Mass.

F. G. Gardner has been appointed acting chief engineer, Kellogg Switchboard and Supply Co., Chicago.

Jay L. Hench, vice-president of Mid-West Forging & Manufacturing Co. since 1924, has been elected president and treasurer to succeed the late George H. Jones. He has also been elected president and treasurer, Hillside Fluor Spar Mines.

Charles E. McIntyre has been appointed assistant manager of sales at Detroit, Mich., Cargnegie-Illinois Steel Corp., Pittsburgh. He succeeds L. B. Worthington who was recently named

Ass't Ordnance Chief

BRIG. GEN. C. T. HARRIS, JR.

Heads Public Relations

BRIG. GEN. A. D. SURLES

Joins O.P.M.

K. P. CROWELL

President, Greenfield Tap

DONALD G. MILLAR

manager of sales, bar, strip and semi-finished materials division of the company.

Brig. Gen. Alexander D. Surles, now with the Armored Force, Fort Knox, Ky., has been designated by the Secretary of War to be Director, War Department Bureau of Public Relations. He fills a vacancy caused by the transfer on August 1 of Major General Robert C. Richardson, Jr., who has been named to command the VII Army Corps. Several years ago General Surles served as chief of the press branch of the War Department. In 1935 he was graduated from the Army War College. He became temporary Brigadier General on July 10, 1941.

Brig. General Charles T. Harris, Jr., assistant to the Chief of Ordnance, U.S. Army, has been appointed a Major-General. He will continue to serve as head of the industrial service of the Ordnance Department. General Harris, a Texan, is a graduate of the United States Military Academy and has had a distinguished career which began in 1907. He served notably in the World War and was awarded the Distinguished Service Medal for his work in applying to U.S. plants foreign methods of making high explosives and propellents. Among his other activities, General Harris was at various times commander of the Watertown Arsenal and Director of the Planning Branch of the Army in the office of Assistant Secretary of War. He is widely known and respected throughout the metal-working industry.

Edward M. Kimball has been appointed New England representative for McKenna Metals Co., Latrobe, Pa.

Cyrus McCormick, grandson of Cyrus H. McCormick, inventor of the reaper, has been appointed price executive of the automobile and truck section of the price division, Office of Price Administration and Civilian Supply. From 1922 to 1931 he was vice-president in charge of manufacturing, the International Harvester Co.

Donald G. Millar, chairman of the board, has been elected president, Greenfield Tap & Die Corp., Greenfield, Mass., succeeding Howard M. Hubbard who resigned. Millar, who will continue as chairman, has been associated with the company for more than six years. He was formerly vice-president, the American International Corp., New York, N. Y. On October 1 Hubbard will become president, the Elliott Co., Jeanette, Pa., manufacturers of turbo-electrical equipment.

J. Walter Snavely, for seven years district manager in the Houston territory, has returned to the sales department of the Conveying and Engineering Products Div., Chain Belt Co., Milwaukee, Wis. George Hunt has been named district manager, industrial sales, with headquarters at Dallas, Texas.

J. M. Studebaker and J. M. Studebaker, III, members of one of the automobile industry's pioneer families, made their entrance into the industrial manufacturing field with the organization in Chicago of the Studebaker Machine Co. Son and grandson of one of the five Studebaker brothers who founded the automobile company that now bears their name, and until recently active in its management as members of the directorate, the two Studebakers will head the new company as vice-president and president respectively. The company will market various hydraulic machines for industrial use and will operate under an exclusive license agreement with Bryant Engineering Corp., Cicero, Ill. Other officers of the company are: C. A. Baxter, vice-president in charge of sales; James Peticolas, vice-president; Marion C. Martin, secretary and general counsel; and Frank B. Stebbins, treasurer and sales manager.

Alex Taub, designer and development engineer for Vauxhall, Ltd., of England, has been appointed chief technical consultant of the automotive branch, Office of Production Management.

E. F. Watts has been elected vice-president, and P. L. Griffin, a director, Binks Manufacturing Co. Griffin will be in charge of the industrial division of the company.

C. B. Voldrich has been named research engineer on the technical staff, Battelle Memorial Institute, Columbus, Ohio, where he will assist in the Institute's program of welding research. Earlier he was a research engineer with the A. O. Smith Corp., Milwaukee, Wis.

Robert B. Whyte has been elected vice-president in charge of operations, MacWhyte Wire Rope Co., Kenosha, Wis. He has been associated with the organization since 1913. In 1925 he was made general factory superintendent, a director in 1937.

Oral B. Wright has been appointed director of sales and advertising, David J. Ross Co., Benton Harbor, Mich.

PLANT EXPANSION

Allegheny-Ludlum Steel Corp. is expanding its Watervliet, N. Y., plant to help meet a heavy increase in the demand for airplane valve steel.

American Metal Bearing Co., Los Angeles, Calif., will build a 200-sq.ft. addition at a cost of $8,400.

Bendix Aviation, Ltd., North Hollywood, Calif., will add three new buildings to its existing plant at a cost of $500,000.

Carboloy Co., Inc., Detroit, began a new plant addition a few weeks ago as

the result of the increased demand for carbide tools.

Century Aircraft Corp., Los Angeles, Calif., is erecting a new plant addition at a cost of $4,500.

Henry L. Crowley & Co., West Orange, N. J., has added a new wing to its plant in order to increase production of its high-frequency iron cores and custom-built ceramics.

Ohmite Manufacturing Co., Chicago, Ill., has completed a new factory addition which doubles the company's production space.

Kelman Electric & Mfg. Co., Los Angeles, Calif., is erecting a new machine shop which will cover an area of 50 x 50 sq.ft. at a cost $3,000.

The armor piercing core plant of the St. Louis Ordnance Plant, St. Louis, Mo., which is being operated by the McQuay Norris Manufacturing Co., will be expanded by the War Department. The plant manufactures .30 and .50 caliber armor piercing ammunition cores. The new expansion will cost approximately $1,725,000.

Pacific Screw Products Co., South Gate, Calif., is erecting a new addition to its existing plant facilities at a cost of $8,000.

Timm Aircraft Corp., Los Angeles, Calif., is erecting a new factory building of 15 x 120 sq.ft. and an engineering building which is 30 x 60 sq.ft. Total cost is estimated at $4,600.

BUSINESS ITEMS

Acro Metals Corp., Los Angeles, Calif., has been organized with a capital of $25,000.

Akwell Tool Engineering Co., Los Angeles, Calif., has been formed by Edward G. Akridge.

American Tool Products, Inc., Los Angeles, Calif., has been started with a capital of $25,000.

California Die Casting Corp., Los Angeles, Calif., has been started with a capital of $10,000.

R. S. Ernst has been appointed to represent the Hele-Shaw Pump Div., the American Engineering Co., Philadelphia, Pa.

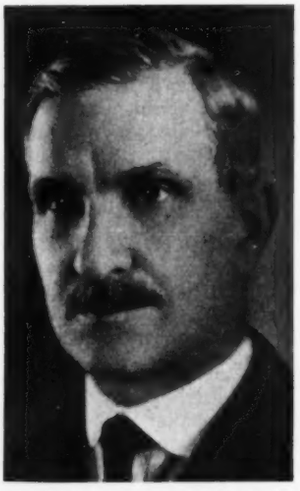
Fisk Airplane and Engine Co., Los Angeles, Calif., has been incorporated with a capital of $100,000.

Westcraft Machine and Engineering Co., Los Angeles, Calif., has been incorporated with a capital of $50,000.

LINCOLN R. SCAFE

New Chief—*Lincoln R. Scafe, formerly general manager of the Fisher Div. of General Motors Corp., Cleveland, has been appointed general manager, the Glenn L. Martin-Nebraska Co. which has recently been awarded a $166,000,000 contract for Martin B-26 bombers*

OBITUARIES



GEORGE L. MARKLAND, JR.

George L. Markland, Jr., Chairman of the Board of the Philadelphia Gear Works, died in Jefferson Hospital, Philadelphia, on Aug. 14 after several months' illness. He was 75 years of age. No man was more widely known through out the machine-tool industry and the metal-working industry in general than Mr. Markland, whose lovable character and keen sense of humor won him a legion of friends.

He gained a high reputation through his management of the Philadelphia Gear Works, which he purchased in 1911. His interests, however, spread far beyond his immediate business. He served his own industry as president of the American Gear Manufacturers Association and also was a former director of the National Association of Manufacturers and of the National Metal Trades Association.

Aside from strictly industrial activities, Mr. Markland was thoroughly alive to his responsibilities as a citizen. His civic mindedness led him into prominence in the affairs of Stone Harbor, N. J., which he served as mayor. He also was president of the First National Bank of that city. Up to the time of his death, since 1935, he had been president of the Philadelphia Board of Trade.

Walter R. Bamford, 56, service director of the Dodge Div., Chrysler Corp., died August 2, from a heart attack. Spending the greater part of his life in the automobile industry, he had been associated with Oldsmobile, Chalmers, Hupmobile, Maxwell and Fulton Truck. He became associated with Dodge in 1925.

D. H. Botchford, 60, former general manager and one of the organizers, Columbia Steel Corp., died recently in Santa Monica, Calif. In 1935 he helped reorganize the Rich Manufacturing Co. of Los Angeles and was made its president.

John M. Klein, 84, tool manufacturer, died recently at Los Angeles, Calif.

Henry Adam Rentschler, 75, secretary and treasurer of the Hamilton Foundry & Machine Co., and secretary-treasurer and director of the Decatur, Ind., Casting Company, died August 4.

August W. Sidell, 76, retired demonstrator for Gisholt Machine Co., Madison, Wis., died recently. One of the earliest members of Gisholt's field organization, he had served as a demonstrator for several years before going to Europe for the company in 1904.

M. J. Tennes, Sr., chairman of the board, the Shafer Bearing Corp., Chicago, died recently. He had served as chairman of the board since 1934.

Dwight Clark Wheeler, president, treasurer and general manager, Acme Shear Co., Bridgeport, Conn., died July 26.

MEETINGS

Associated Machine Tool Dealers of America. Fall meeting, Hot Springs, Va., Sept. 12–13.

National Association of Foremen. Eighteenth annual meeting. Cleveland, O., Sept. 19-20.

Iron & Steel Exposition. Cleveland Public Auditorium, Cleveland, O. Headquarters Hotel Statler. Sept. 23-25.

Society of Automotive Engineers. National Tractor meeting. Schroeder Hotel, Milwaukee, Wis., Sept. 25-26.

SHOP EQUIPMENT NEWS

Beatty 400-Ton Flanging and Forming Press Has Rapid Hydraulic Operating Strokes

Each of the two vertical cylinders and the horizontal cylinder of the Model 1985 high speed flanging and forming press, manufactured by Betty Machine & Mfg. Co., Hammond, Ind., is equipped with a single-acting main ram and a double-acting small cylinder to give high speed on advance and return stroke, thereby increasing the production of the press. With the two vertical cylinders operating singly, assuming that the press is used for a flanging operation, the front cylinder will advance to the work on the down-stroke at a rate of 290 in. per min., and will hold under pressure while the second ram advances at the same rate. This ram presses under full load of 200 tons at the rate of 21 in. per min. The return speed on both rams is 390 in. per min. singly. All four cylinders are controlled by manual valve levers.

Tonnage capacity of each of the two vertical cylinders is 200 tons. The hydraulic circuit can be so arranged that when operating the two vertical cylinders as a 400-ton unit, one lever controls both cylinders. This simplifies the operation of the press, and eliminates the possibility of greater pressure being applied to one cylinder. Operating speeds of the 400-ton, two-cylinder units are one-half the speed of the cylinders operating singly. Operating speeds and pressure of the horizontal cylinder are the same as for the vertical cylinders operating singly.

Maximum daylight of the press, with the two vertical cylinders up, is 45 in. Stroke of the cylinder is 24 in. Depth of stroke from center of two vertical cylinders to housings is 66 in. The lower platen is 48 in. right to left, and 88 in. front to back.

Cincinnati Rolling Mill Shear Has 4 ft. by 1 in. Capacity

New rolling mill shear manufactured by Cincinnati Shaper Co., Cincinnati, Ohio, is the first announcement of a 1-in. mild steel capacity Cincinnati shear in less than 6-ft. lengths. This small 4 ft. by 1 in. shear has already been furnished to Anaconda American Brass Co. for continuous mill cutting of brass and zinc. Speed of the shear is 30 strokes per min.

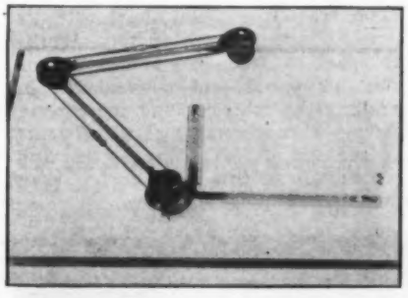
Construction of the 6204 shear is rugged and dependable. All the main members are of solid rolled steel plate; this includes the housing, upper and lower knife bars, table, back brace and the pitman links. Independent hydraulic hold-downs effectively grip the stock for the cut. The Cincinnati hydraulic hold-down system delivers a heavy uniform pressure along the full length of the stock, thus preventing slippage of the work regardless of variation in thickness. These hold-downs are a series of independent plungers actuated by oil pressure.

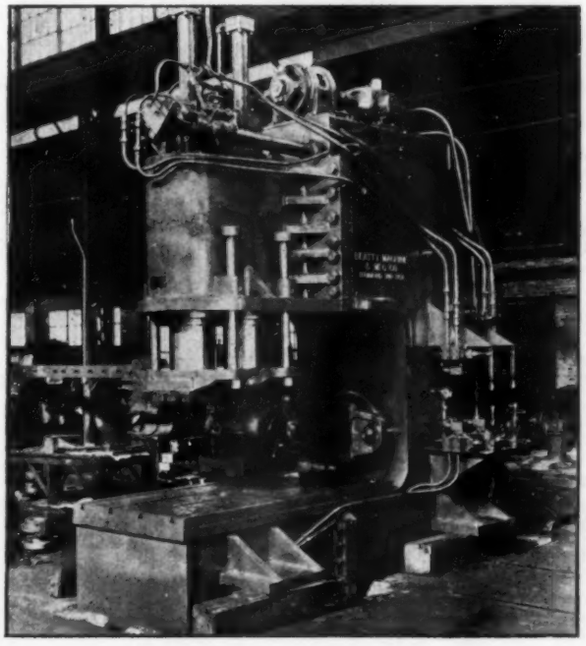
Automatic sight feed pressure lubrication assures adequate oiling to all power driven bearings without loss of the operator's time. The fly-wheel shaft, drive gear, clutch, and hold-down mechanism all run in oil.

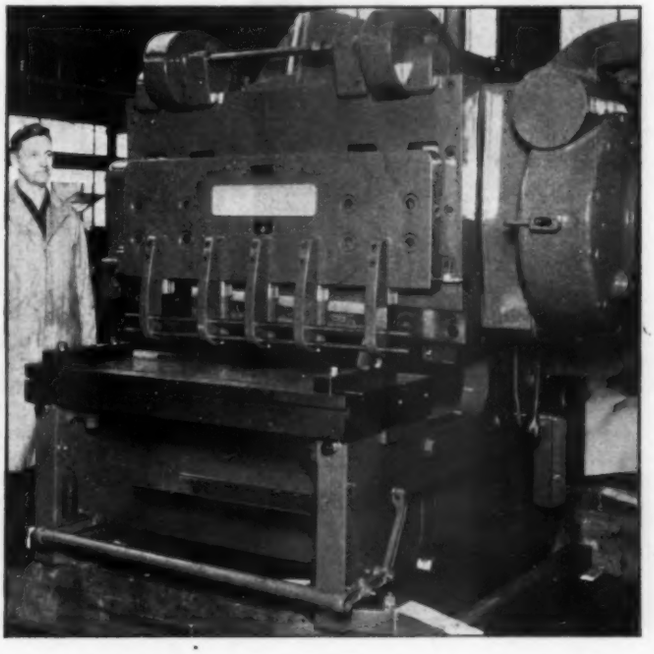
Post's True Line Drafter Eliminates Smudged Drawings

The Frederick Post Co., Hamlin & Avondale Aves., Chicago, Ill., has announced their new True Line drafting machine which embodies a protractor, vernier, T-square, scales and triangles. It is claimed to be easily and conveniently operated and to eliminate smudging and blurring caused when instruments are moved over the drawing.

The machines are equipped with







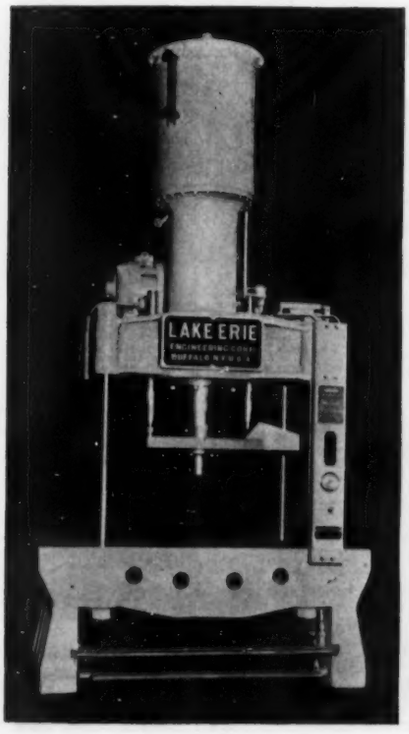
"Quick Flick" control. A flick of the thumb from its natural position, and the scales are released for 15-deg. automatic stops or for intermediate stops and locking. Again, a flick of the thumb and the scale can be set at any angle with a protractor and vernier reading of zero to zero. No adding and subtracting is necessary for details around a focal point in the drawing.

In all these drafting machines, the design permits the use of the instrument with the elbow to the left or to the right. The protractor can be used at any angle in the complete circle, so that the total area of the board is made accessible. Hardened steel construction gives greater accuracy with fewer parts. The index plate, which is subject to the greatest wear, is notched to take up any wear automatically.

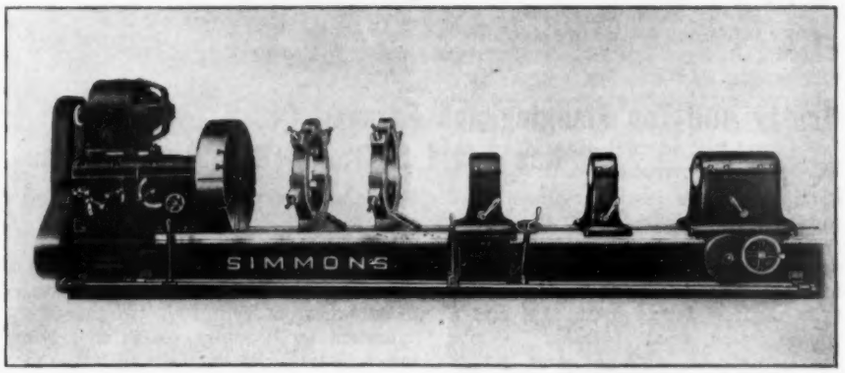
Lake Erie 100-Ton Press Straightens Armor Plate, Bars

Lake Erie Engineering Corp., Buffalo, N. Y., announces a new 100-ton hydraulic press for straightening light armor plate and bars. This type of press with its control of pressure is claimed to provide the ideal means for straightening plates which have become distorted or warped in heat-treatment.

The press is self-contained with its pumping unit mounted on top. Working space is accessible from all four sides for speed and convenience in handling the material and for correct spacing of supporting blocks on working surface of bed. The design and construction of this machine has been standardized in various sizes.



Simmons 54-in. Heavy Duty Boring Lathe Has Simpler Headstock with Few Wearing Parts



The Simmons Machine Tool Corp., Albany, N. Y., has just introduced a new 54-in. heavy duty boring lathe which is of massive, rugged design for heavy duty. The bed has double wide walls running its full length, tied together with double walled cross girts of modern oval construction. The bed ways are extra wide, giving ample support to the carriage and a firm foundation for the headstock and the tailstock.

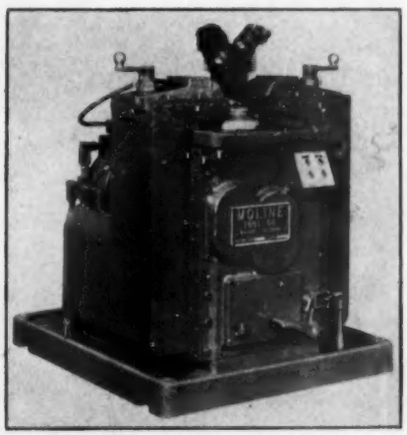
The Simmons headstock is of a simplified design to provide the required range and number of spindle speeds with as few wearing parts as possible. It is fully inclosed and all bearings and gears are lubricated from positive pressure oil pumps delivering filtered oil. The main spindle is of hammered steel, heat-treated. The spindle bearings are extra long and large in diameter to provide a maximum area of bearing surface. Either six or four speed changes are provided to the internal face plate through sliding spur tooth gears and one heavy jaw clutch.

The bar feed screw, 4½-in. dia., is milled from high carbon special steel screw stock. Heavy duty ball thrust bearings are provided at the ends of the screws. Power rapid traverse to the screw is through a sliding gear, providing means for moving either front or rear bar support at speeds up to 25 ft. per min.

The boring bar tailstock, of exceptionally heavy and rugged design, takes a maximum size boring bar of 8 in. dia. The head bar support contains a driving unit similar to the tail support which may be used for feeding short boring bars and for rapid power traverse of the unit.

Specifications: Swing over bed. 55½ in.; swing over carriage, 42 in.; maximum boring length one setting (40 ft. bed), 13 ft. The four-speed headstock gives spindle speeds from 1.6 to 50 r.p.m.; the six-speed head-stock gives spindle speeds from 1.8 to 38 r.p.m. Hole through the spindle is 2¾ in. Width of the bed is 42 in. Depth of bed is 24 in. Motor horsepower recommended is 30 to 50 hp.

Moline Tool Develops Special Miller for Aircraft Production



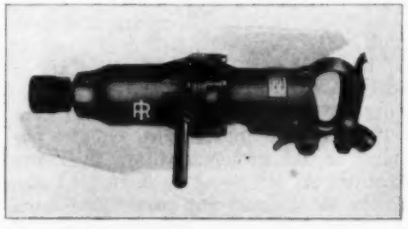
Developed for backfacing the bolt holes in the flanges of radial engine cylinders, a new No. 24 miller is announced by Moline Tool Co., Moline, Ill. The design of this machine is such that the driving gears and cams are inclosed and forced lubrication is provided for all of these inclosed rotating parts. Cutting fluid is delivered to the cutters from a reservoir which is cast in the machine column.

Operation of the No. 24 is semi-automatic. After loading the fixture, the operator moves the cutters into position over diametrically opposite holes by means of hand levers. The operating cycle is started by push button to bring a driving spindle up into each of the two cutters to rotate them during the feed cycle. After the cycle is completed and the drivers have withdrawn from the tools, the work is indexed by the operator and the next pair of holes is faced. Indexing takes place without manual withdrawal of the cutters. Such with-

drawal by means of the handlevers is necessary only before the work is removed from the fixture. Interlocking of the electrical control with the mechanical features prevents the feed cycle from starting unless the work is properly indexed.

Two New Impact Wrenches Offered by Ingersoll-Rand

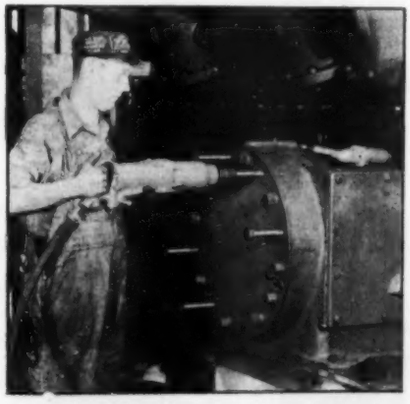
Two new and improved, air-operated impact wrenches, designed with patented Pott impact wrench principle which localizes steel-to-steel impact without transmitting shock to other parts of the tool, have been developed by the Ingersoll-Rand Co., Phillipsburg, N. J. The size 534 wrench, for removing nuts up to 1¼-in. bolt size, has a small nose diameter and short



Ingersoll-Rand's size 534 wrench

overall length which permits operation in close places. Weight of this tool is 27¼ lb. Average working speed at 90 lb. per sq. in. pressure is 635 r.p.m. The length of this wrench is 18 5/16 in., less chuck.

The size 504 impact wrench weighs



The size 534 impact wrench handles easily in running up cap screws

only 4 lb., is reversible and can handle up to and including ¾-in. (bolt size) nuts. A form-fitting pistol grip handle, short overall length and small nose diameter permits its operation in close places. This tool is claimed to be ideal for modern industrial plants and assembly departments. Average working speed at 90 lb. per sq. in. is 1,050 r.p.m.

Riveting Position Easily Adjusted In Hanna Portable Hydraulic Riveter

Ability to change with ease from one riveting position to another is the main feature of the portable hydraulic riveter just announced by Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. In this machine there are no hoses to hinder the rotation of the riveter upon its suspension axis, or affect its center of gravity while moving from one rivet to another. The riveter is free to rotate or tilt in any position.

A pushbutton on the riveter initiates the riveting cycle. The rivet die then advances rapidly at low pressure until it contacts the rivet; pressure increases as the rivet is driven. Reversal of the die occurs the instant the rivet is completely driven, and the return to starting position is rapid. For safety, the operator can reverse the stroke instantly and automatically.

Pressure exerted by the riveting die can be regulated by turning the tonnage control dial. Maximum ram pressure is 17½ tons, with a ram stroke of 3 in. This will drive a ⅜-in. dia. rivet cold, ⅝-in. dia. hot. Recommended pressure for driving various diameters of rivets and types of heads are embodied in the instruction plate.

The hydraulic riveter is actuated by a high pressure, completely inclosed pump which is belt-driven by a 2-hp.

horizontal motor. Pump, valve, switches and gages are all mounted on a panel which can be removed as a single unit in a few minutes for inspection or servicing.

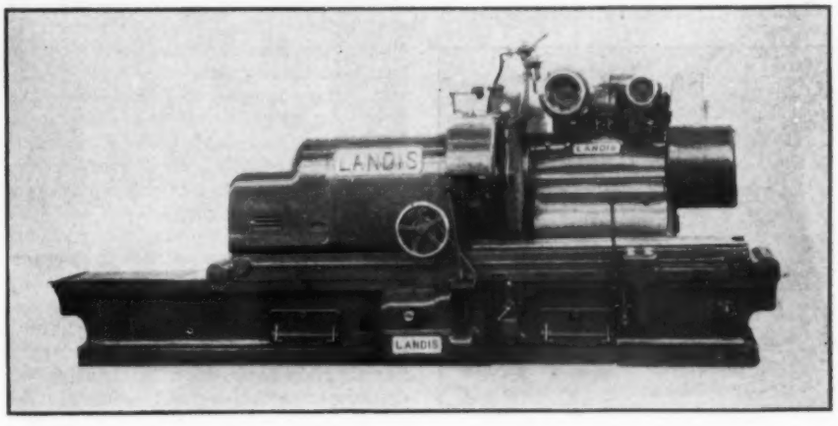
Standard C-frame yokes are available with 4-in. reach, 6-in. gap; 6-in. reach, 6-in. gap; 8-in. reach, 8-in. gap; 10-in. reach, 8-in. gap; and 12-in. reach, 8-in. gap.

Landis Tool Designs 25-In. Type D Radial Crank Grinder

Although designed especially for radial crankshaft work, the new 25-in. Type D radial crank grinder of Landis Tool Co., Waynesboro, Pa., with the proper tooling is suitable for a wide variety of operations, among which are: rough grinding the pin diameters and adjoining radii; squaring the ends of the center section; grinding the web faces adjoining the pins of the center section; squaring the ends of the pins on both the front and rear sections; grinding the web faces adjoining the pins on both the front and rear sections; semi-finish grinding the pin and adjoining radius on both the front and rear sections. The swing of 25 in. gives the machine sufficient capacity to handle the largest of radial cranks.

The headstock is so designed that the long or short end of the shaft can be inserted in the spindle. A work speed of 30 or 55 r.p.m. is available on the standard machine. To facilitate changing the work, the work rotation will always automatically stop at the same point. Work holding fixture is equipped with a mechanical clamp.

A 42-in. dia. grinding wheel is used, permitting a large amount of wheel wear before changing of the wheel be-



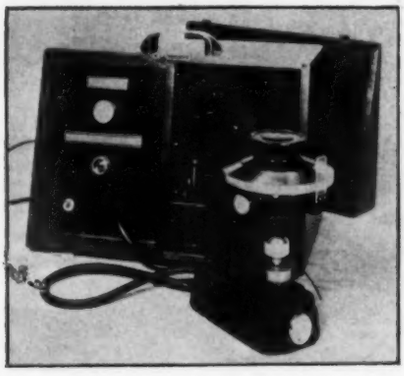
comes necessary. A hydraulic straight infeed mechanism is used with all of these machines. For web face operations a movement of 12 in. is provided. A convenient lever at the front of the machine controls the direction of the feed, while a nearby valve regulates the speed of the slow or dressing feed.

The wheel base of all of these machines, excepting the ones tooled to finish-grind the pins after shaft assembly, is set at a 4-deg. angle. In grinding web faces, the wheel is fed laterally so that it is in a straight line contact with the web face instead of in total contact. This provides a much freer cutting action and better finish. Hydraulic power is used to traverse the work table. A central control causes work rotation to start or stop, the work table to traverse either right or left, and will jog the work.

Carson Micrometer Measures Thickness of Soft Materials

By eliminating contact pressure in measuring thickness, the Carson Rubber Micrometer, made by Instrument Specialties Co., Inc., 240 Bergen Blvd., Little Falls, N. J., makes it possible to measure soft or compressible materials with a high degree of precision. The micrometer consists of a precision micrometer head fitted with a large dial and mounted in a rigid instrument frame. When the micrometer tip is brought into contact with a metallic rider resting upon the work, exact instant of contact is indicated by a green light before any pressure is exerted on the piece being measured. This is made possible by a special electronic circuit operating on a new "currentless contact" principle which is sensitive to displacements as small as five millionths of an inch.

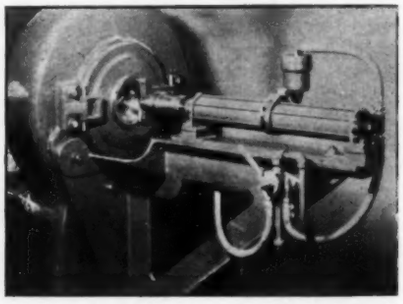
The instrument is available with a variety of special fittings and attachments for specific measuring problems on such materials as rubber, paper, plastics, cork, fibre, leather, felt, insulated wire and textiles. Two standard dials are available: a 2½-in. dia. dial with divisions of 0.0001 in., and a 4½-in. dia. dial with divisions for every 0.00005 in. The larger dial has a vernier permitting accurate adjustments to a fraction of a division.



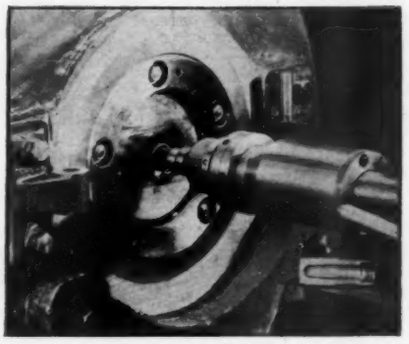
Shell Banding Speeded by Automatic Feed On Rotary Swager of Standard Machinery Co.

The rotary swaging machine, for many years manufactured by the Standard Machinery Co. of Providence, R. I., is now available with a special automatic feed for the high production banding of all types of shell within the size range of 20 to 155 mm. The automatic feed is available in two types: an airdraulic cylinder controlled through a foot valve or hand valve for most efficient production; and a mechanical feed by a capstan wheel. Production rate with the airdraulic cylinder feed ranges from 240 to 350 pieces per hour on 37-mm. shell. Mechanical feed gives approximately 20 percent less production. Facilities for handling the shell can be quickly changed within the same range of sizes to accommodate different types of shell.

Operating cycle of this process is as follows: If the shell is of the H.E. type having a powder cavity, it is placed on the end of the mandrel in the fixture. On the other hand, the A.P. or solid shell is located in a socket in the fixture rather than the mandrel. The band is loosely fitted over the end of the shell and the shell is advanced into the dies. The locating sleeve, operated automatically in connection with the feeding fixture, holds the band in its proper position over the groove. As the swaging is started, the sleeve is stopped and prevented from entering the dies. Between one and two seconds are required for the banding of this shell. Reversing the action, the feed automatically withdraws the shell from the machine and strips it from the mandrel.



Airdraulic cylinder automatic feed, shown mounted on rotary swager, gives highest banding production



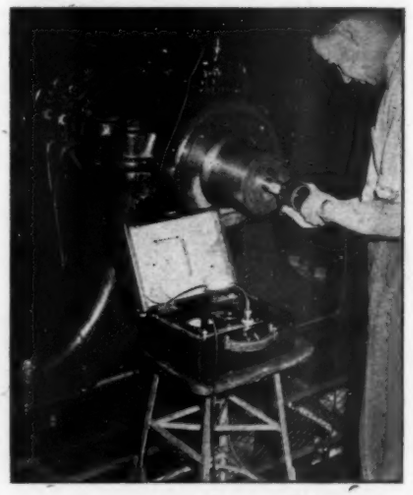
Close-up view shows how a solid shell mounted in the feed socket is advanced into the swaging dies

In the swaging operation, a number of light blows on the band tend to flow the guilding metal or copper completely into the band groove, base and sides, as well as around the knurling. Bands removed after attachment with this method show that the material goes so far as to register the tool marks present in the bed of the groove.

G.E. Designs Portable Machine For Balancing Heavy Rotors

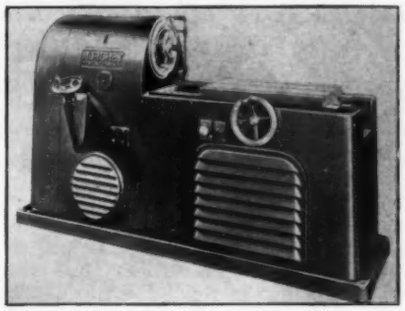
Rotors that are too heavy for any available balancing machine, such as large turbines, generators, can be balanced with the new portable dynamic balancing machine designed and recently introduced by General Electric Co., Schenectady, N. Y. By permitting accurate balancing under operating conditions in the rotor's own bearings, the equipment eliminates the need for shipment of the rotor to a balancing machine, thereby making correction of unbalance simpler, faster, more complete and less expensive than methods formerly used.

The balancing equipment consists of three principal parts: a sine-wave alternator, a vibration velocity unit, and an indicating unit and its associated circuits, all fitted in a handy carrying case. It may be used during initial manufacture or installation of a rotor; after subsequent servicing; or to correct unbalance caused by pitting or corrosion. Rotors may be checked with the device while running in their own or in substitute bearings.



Hob of Murchey Thread Milling Machine Feeds Eccentrically Around Work

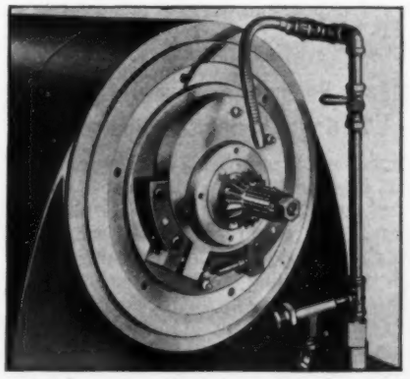
In the new No. 32 thread milling machine of Murchey Machine & Tool Co., Detroit, Mich., the milling hob is revolved eccentrically about the work, and is simultaneously rotated on its own axis while being advanced into the work for a sufficient distance to produce the full depth of the thread. The



Threads from 1 to 4 in. dia. can be milled in this Murchey machine

cutter, continuously rotating on its own axis, as it is carried around the work is simultaneously advanced by a lead screw to produce the desired helical thread. The cutter spindle after completing the operation automatically returns to center, permitting facing or counterboring operations with concentric relation of thread and counterboring assured.

The machine is intended for the mass production of right- or left-hand in-



Close-up of machine shows eccentric which revolves hob around thread

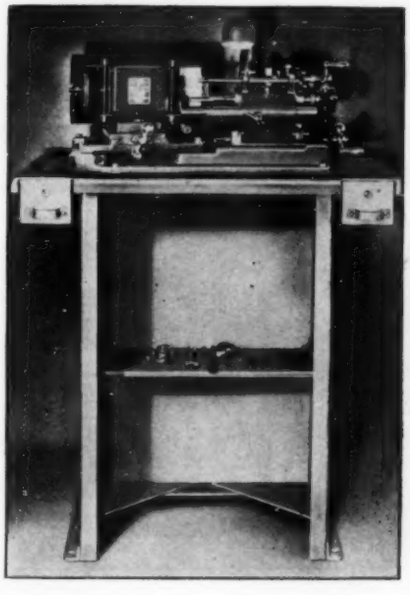
ternal or external threads from 1 in. dia. up to 4 in. dia. and 3 in. in length by means of annular milling cutters covering the full length of thread. This machine is now also being used to thread the base end of the 3-in. AA shell, which has a thread diameter of 2 7/16 in. for a length of 16⅝ in. These left-hand threads, tight to a shoulder, are completed at the rate of 73 per hr.

The bed of the machine is a semi-steel casting of heavy box-type construction, assuring great rigidity and providing an inclosed space for motors, starter, flexible pulley unit, lubricating and cooling systems, and hydraulic equipment. The fixture table is tapered into the bed, having a 30-in. bearing on the ways. All moving parts are of hardened and ground alloy steel, working on straight surfaces of nickel iron. The working cycle is hydraulically operated. To change pitches from right-hand threads to left-hand threads, or vice-versa, it is necessary to change the lead screw and segmental lead nuts, as well as the milling hob or milling head. The complete change-over can be made in less than 30 min.

Blake J-B Tap Grinder Sharpens Taps on The Chamfer

New No. 1 and No. 2 J-B tap grinders, designed for sharpening taps on the chamfer, and a new J-B tap grinder knee-room pedestal are announced by the Edward Blake Company, 634 Commonwealth Avenue, Newton Centre, Mass. The grinders will sharpen 2, 3, 4 and 5-flute taps and can be equipped for grinding 6-flute taps or 6, 8 and 10-flute taps. Both right and left-hand taps, can be sharpened. The capacity of the No. 1 J-B tap grinder is as follows: taps held on O.D. of thread, any length, No. 0-½ in.; taps held on shanks, any length, No. 0-⅝ in.; taps held on centers, lengths under 5 in., No. 0-2 in. The No. 2 J-B tap grinder is similar to the No. 1 except that it is furnished with a 10-in. extended bed for sharpening the chamfer on taps up to 12 in. long held on centers.

Taps can be inserted or removed from the machine in a few seconds,

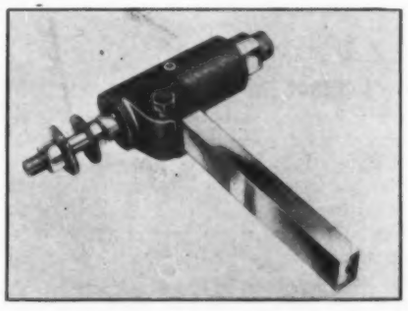


and a simple locating device insures correct positioning and duplication of work. The desired relief is obtained by a simple screw adjustment of an eccentric mechanism. The motor head unit can be swiveled in a wide arc on any desired chamfer angle. The machines are furnished complete with motor, two grinding wheels, wheel guards, diamond wheel dresser, wrenches, one draw-in master collet, and two bell centers.

The new J-B Grinder Pedestal is furnished as an optional extra. This rugged pedestal is designed for maximum efficiency for either the seated or standing operator. Two drawers are furnished for storing extra bushings, wrenches, and other tools.

Stow Tool Post Attachment Permits Grinding on Lathe

Lathes can be adapted to many different grinding operations, both external and internal, with a new tool post attachment now being produced by Stow Mfg. Co. Inc., Binghamton, N. Y. The attachment is driven by a



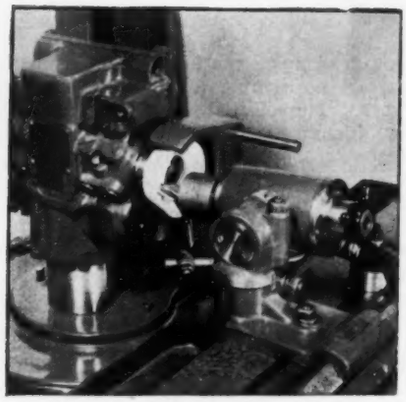
Stow portable flexible shaft machine. The device accommodates grinding wheels as large as 6 in. dia. with 1-in. face. By taking off the clamp spindle and substituting the Stow collet chuck, a variety of mounted wheels and points can be operated for internal grinding and recess surfacing.

On the tool end, the new attachment is fitted with a combination radial thrust and annular ball bearing, and on the shaft end, a floating, self-aligning ball bearing is used. This rigid spindle support insures true running at speeds as high as 6,800 r.p.m.

B. & S. Attachments Sharpen End Teeth of End Mills

Brown & Sharpe Mfg. Co., have redesigned their No. 10 and No. 13 end mill sharpening attachments to permit the sharpening of the end teeth of end mills, as well as peripheral teeth previously accommodated. This attachment is claimed to be of particular value in sharpening the peripheral teeth of steep spiral end mills having straight or tapered shanks.

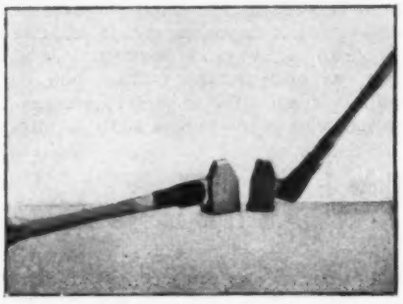
The attachment spindle is carried in

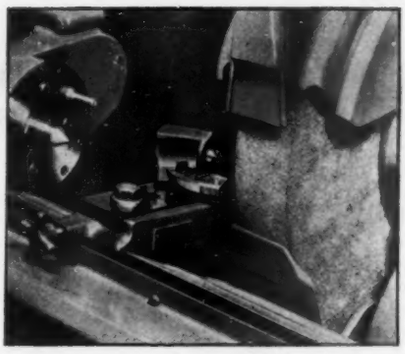


a body that can be set at an angle in both a horizontal and vertical plane, with rigid clamping provided for both adjustments. Graduations of 2 deg. provide for angular settings up to 16 deg. either side of zero in the vertical plane; and to 90 deg. either side of zero in the horizontal plane, the base itself being aligned by the scraped inverted "V" of the table top. Zero-marks 180 deg. apart on the spindle body provide for sharpening both right-hand and left-hand cutters.

Pittsburgh Type Holder Is Adjustable to Ease Stamping

What is claimed to be the only adjustable type holder on the market has been announced by the Pittsburgh Stencil and Tool Co., 405 Penn Ave., Pittsburgh, Pa. This solid chrome-nickel holder with its Safeloy steel type has no small parts to break or work loose. It is claimed to relieve much of the back-breaking job from the stamper, whether he be tall or short, or whether the work is on the floor or waist high. This holder is made in all sizes to take from 1 to 10 Safeloy unbreakable steel type characters ranging from 1/16-in. to 1 in.





Brown & Sharpe Add Attachments For Radius Wheel Truing

Providing a means of forming wheels for grinding to shoulders where a fillet is required, and permitting shaping either the right-hand or left-hand corner of the grinding wheel to any convex radius from zero to ½-in., new radius wheel truing attachments have been announced by Brown & Sharpe Mfg. Co., Providence, R. I. The attachments fit the No. 5 plain grinding machines, the No. 10 and No. 12 plain grinding machines, and the No. 20, No. 22, No. 23 plain grinding machines.

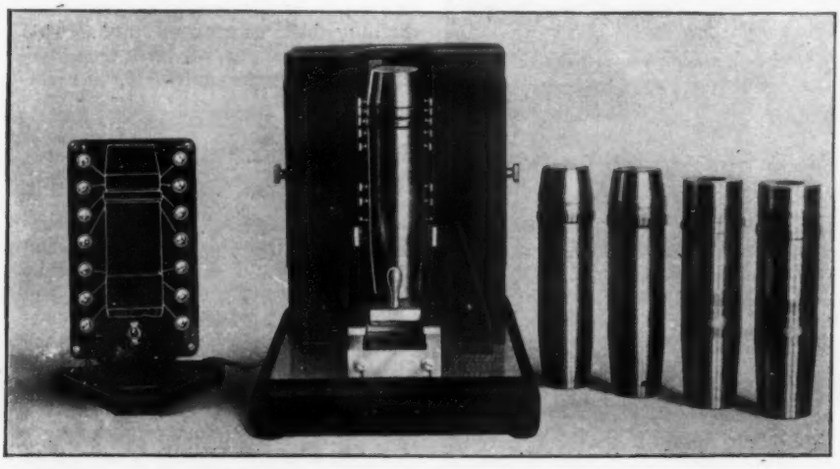
The base of the attachment is secured to the table of the machine by a clamp, which is operated by a knob at the outer end of the attachment for the No. 5 machine and by a lever on the other sizes. The hand-operated diamond tool holder is supported and guided by a fixed segment-shaped piece. The segment, in turn, is mounted on a slide which is adjustable transversely in the attachment base and is clamped in position by a screw. This transverse adjustment permits shaping the grinding wheel without changing its position when the machine is set up for grinding work of any diameter within its recommended capacity.

P & W Multiple Electric Contact Gages Speed Inspection

By watching pairs of red and green lights, an inspector using one of the new multiple electric contact gages manufactured by Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford Conn., can tell instantly in one operation if any section of a part is too small, too large, or within the specified limits. Each of these gages is engineered for its particular job; illustrated here is a gage made for inspecting shell, but the principles can be adapted to a large variety of work.

The electric contact shell gage comprises the signal box, the gaging fixture, and the masters. The gaging fixture is composed of a base with positioning slide or ways, and a vertical column to which are attached the adjustable gaging sections. As the shell is slid into the gaging position, each of the floating sections automatically aligns itself, producing an accurate diameter check regardless of possible eccentricity between the several dimensions. Each gaging section has a fixed anvil and a movable spindle which actuates the contact arm. The light contacts are readily adjustable so that diameter tolerance can be set quickly and easily. A shell is within correct limits when all red (to left of signal box) and green (to right of signal box) lights go out.

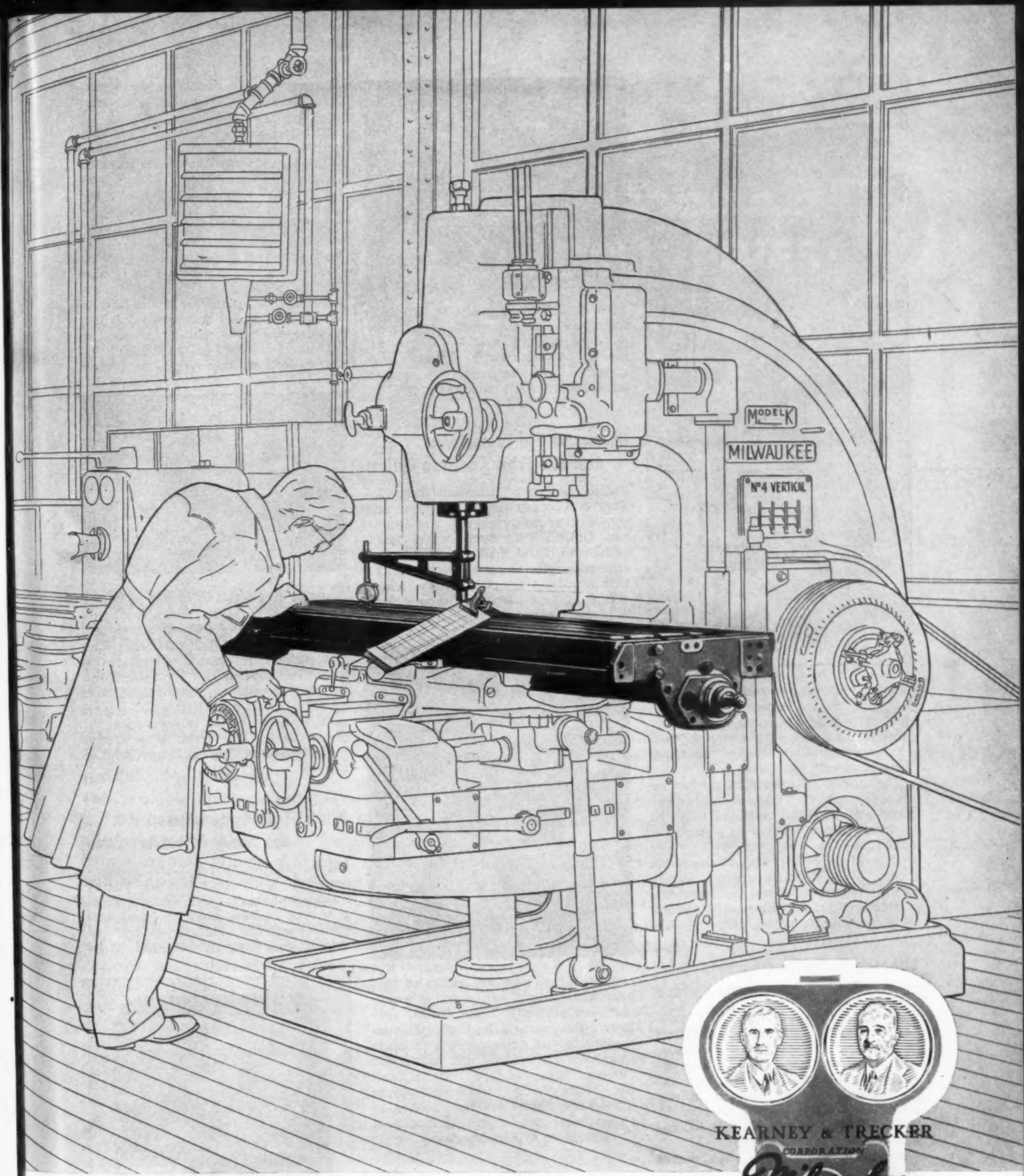
Maximum and minimum masters are furnished with this gage for setting purposes. These are made in sections for manufacturing reasons, but are the equivalent of solid masters when assembled. The electric contact gages are compact, rugged and provide for easy manipulation of the product. Moving parts are reduced to a minimum.



Moore Pneumatic Comparator Gage Eliminates Wear Factor

A pneumatic comparator gaging method has been developed by the Moore Products Co., 3629 N. Lawrence St., Philadelphia, Pa., which accurately amplifies small dimensional differences and shows them on a dial type indicator. The measuring points, which are actually air nozzles, do not touch the piece being gaged, and accordingly do not wear. Externally adjustable limit pointers are provided when speed of inspection is important.

In operation, a restricted amount of air from a filtered and regulated source of supply is admitted to the dial gage and measuring nozzle. Variations in the clearance between the nozzle and the work permit more or less air to escape from the nozzle which changes the pressure and indicates on the dial in decimal parts of an inch. The pressure regulating equipment supplied insures uninterrupted performance regardless of wide fluctuations in the main air supply line. The presence of



"Squaring table top with spindle" . . . one of many precise alignment checks made on *Every* Milwaukee Milling Machine.

KEARNEY & TRECKER CORPORATION
Milwaukee
MILLING MACHINES

Milwaukee MILLING MACHINES

heavy grease or loose dirt on the piece has no effect on the readings, since the high pressure air instantly cleans the surface.

For internal bore gaging, especially for small holes and long tubes the plug is merely a guide, and the measuring nozzles are recessed below the surface. The plug has ample clearance over the minimum tolerance and fits quite closely in the bore. The two nozzles are dia-

metrically opposite to measure the true diameter and to compensate for the side motion of the plug. A 90-deg. rotation measures "out-of-round," and a lengthwise motion measures taper and "bell-mouthed" conditions.

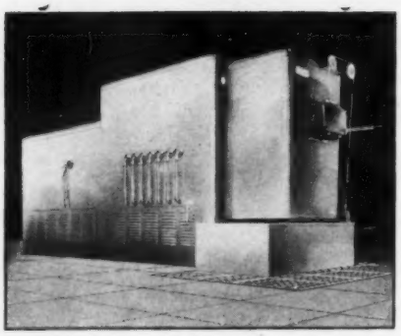
The amount of magnification can be made to suit the tolerance measurement with 0.001 in. indicated by 2 in. or more pointer movement. Accurate dimensions can be read within less than 1/32 in. of the edge of the work piece. In applications where it is desired to record the actual measurement, a circular chart recording meter is used instead of the indicating dial.

Lithcarb Carburizing Furnace Gives Bright, Clean Surface

Embodying the use of Lithco compound which completely neutralizes scaling and decarburizing reactions, and provides fast, bright, gas-carburizing without scale, soot or tar formations, a new Lithcarb atmosphere furnace has been announced by The Lithium Corp., Raymond-Commerce Bldg., Newark, N. J.

Because the reversible reactions of the carburizing cycle are eliminated in the Lithcarb process, steels will take on carbon continuously. Thus carburizing time is reduced to approximately one-third of the time necessary with other methods.

The model LDU-1230-6 furnace illustrated has a temperature range of



1,200 deg. F. to 1,800 deg. F. Working dimensions of the muffle are 12 in. wide, 30 in. long, and 6 in. high. It has a tubular frame for maximum strength, and the shell is all-welded, one-piece, modern construction.

Corrective Eye Protection Available From American Optical

For the benefit of the many industrial workers who are visually deficient and should wear safety goggles, the American Optical Co., Southbridge, Mass. announces it has made available seven different styles of safety goggles fitted with Super Armorplate lenses which can be ground to prescription. These hardened prescription lenses not only

correct but also protect vision so that maximum safety and working efficiency are assured. These special protective-corrective safety goggles, according to the announcement, include spectacle and side-shield types for different kinds of eye hazards, and the extra-strong, hardened Super Armorplate lenses can be obtained in either clear white or Calobar and Crookes glare protection glass.

Spotfacer and Boring Tool Announced by Bokum

Eliminating extra tools often required to do certain jobs, a new B & B spotfacer and boring tool manufactured by the Bokum Tool Co., Detroit, Mich., performs a wide variety of operations. Heavy cuts can be made in a short time.

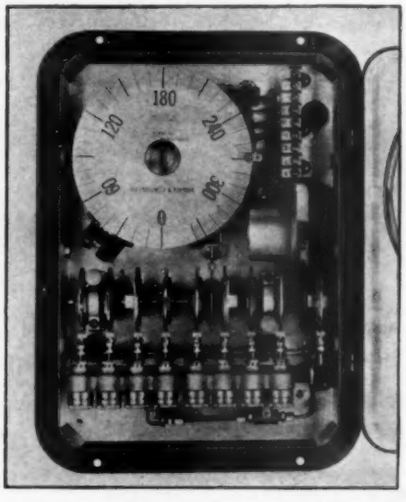
The tool consists of a head (or bar) with a cutting blade running through a slot at the end of it at right angles. Located on the head is a dial with micrometer readings which enable the operator to set and lock the blade securely to precise diameter measurements within ten-thousandths of an inch. The tool is made in three models with standard blades providing a range of boring diameters up to 22 in. A wide range of spotfacing is also offered. With the aid of a standard small tool adapter, the same tool can be used to bore holes as small as ¼ in. dia.

In addition to conventional boring,

this new tool has advantages in boring long holes in either forward or inverted direction. Another adaptation of the same tool for this work—the B & B line borer—has a tapered shank at both ends. One end is placed in the spindle in the conventional manner and the other end, forming the support, is placed in the tapered end of a plain shaft. This latter may extend beyond the work to reach any bearing support.

Bristol Time Cycle Controller Has Easily Adjustable Cams

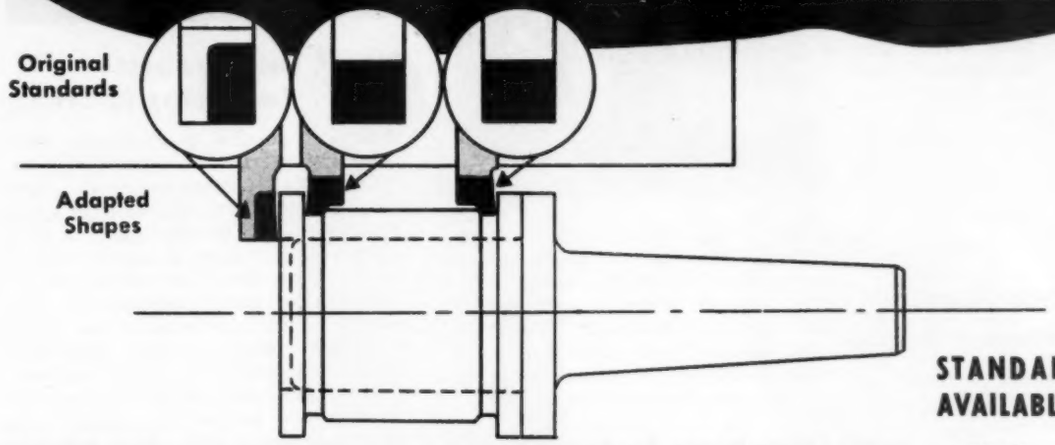
Known as the Model A-118 impulse-sequence cycle controller for timing mechanical operations in industrial processes, a new multiple cam time cycle controller announced by the Bristol Co., Waterbury, Conn., is de-



FEDERAL-MOGUL

Saves 6 to 8 Weeks on

CARBIDE TOOL DELIVERIES!



QUICKLY ADAPTS CARBOLOY STANDARD TOOLS TO FORM CUTTING . . .

To eliminate weeks of waiting for special form tools required to machine their bushings and bearings, Federal-Mogul Corporation—well known Detroit manufacturers, evolved this simple, fast method:

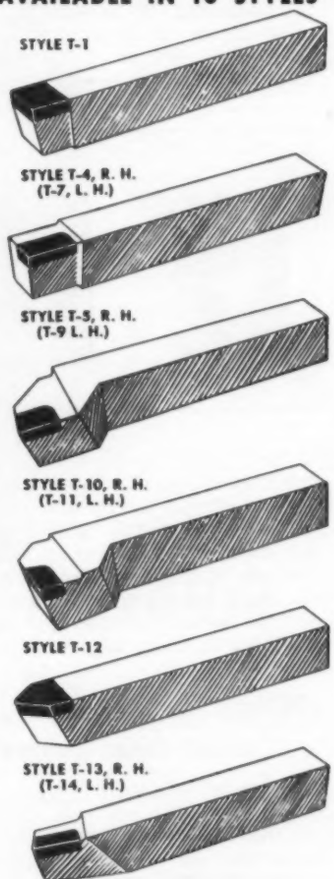
Instead of ordering form tools, Federal-Mogul Corp. orders Carboloy STANDARD-STOCK tools and quickly adapts them to meet their special requirements.

The example illustrated above is typical. The tool at left is adapted from a Carboloy Standard Style 4. Federal-Mogul orders this tool from stock and grinds the slight offset required. The two tools at right are adapted from Carboloy Standard Style 1. Federal-Mogul orders these from stock and grinds the ends to the form shown. All adaptations are made in the Federal-Mogul tool room.

In setting up this "help yourself" plan, Federal-Mogul last Fall checked all of their form tool drawings against Carboloy standard tool specifications. All standard tools that could be readily adapted to their special form requirements were so identified. Standard tools were then stocked and made immediately available for current demands.

Through this simple procedure form tools get on the job FAST—at Federal-Mogul. May we help you get the same fast results? Send for Catalog GT-129.

STANDARD TOOLS ARE AVAILABLE IN 10 STYLES



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Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Worcester, Mass.

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CARBOLOY STANDARD TOOLS & TIPS

"You ALWAYS Get Standards FASTER Than 'Specials'"

CATALOG GT-129

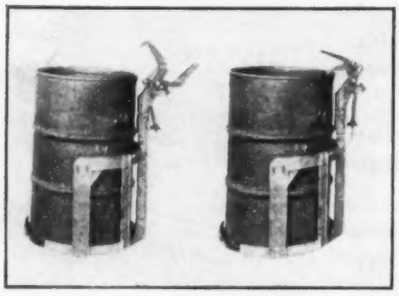
SEND FOR FREE CATALOG

signed especially for use on tire molds and any other plant process where a number of factors must be accurately timed according to a fixed program. In this controller the time measurement and the pilot valve operation are handled by separate mechanisms. Separation of these two basic functions makes possible a design that gives accurate timing of the factors under control, high speed and torque for pilot valve operation, and flexibility of application.

Timing is accomplished by a Telechron-driven aluminum disk on which is printed a 25-in. time scale. The desired schedule is incorporated into the controller by punching holes with an ordinary ticket punch on the time scale. The disks for new cycles or schedules of operation can easily be made. The cams are individually adjustable and their setting does not require fine adjustment.

Lewis-Shepard Toggle Harness Facilitates Dumping of Barrels

A quick-locking harness to speed up and make more efficient the handling and dumping of barrels and drums is offered by the Lewis-Shepard Sales Corp., 245 Walnut St., Watertown, Mass. A standard Lewis-Shepard bar-

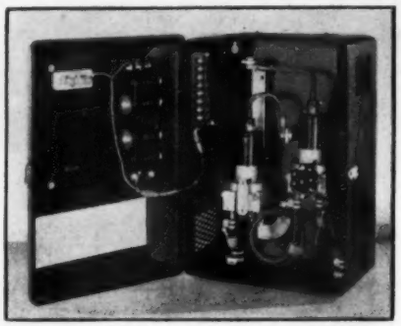


rel hoop truck deposits a drum directly into the harness, eliminating the necessity for affixing the harness or adjusting it to the drum. The drum does not have to be placed on the floor first as formerly. The harness is equipped with a spring toggle, is arc welded throughout, and can be supplied for any size of drum.

150-Amp. Weld-O-Trol Has Water-Cooled Ignitron Tubes

A new electronic welding contactor for spot welding applications, known as the SW 150 Weld-O-Trol, has been announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The unit is rated equivalent to a size 2-W mechanical contactor at 220 or 440 volts, 50/60 cycles. Welding current is handled at extremely high rate of interruption by two heavy-duty water cooled ignitron tubes. Water cooled clamps made of copper tubing cast in heat conducting alloy hold the tubes in position; provisions are made for removal of tubes without disturbing the water connections. A thermostat mounted on the cooling clamps protects the tubes against high temperatures caused by failure in the water supply.

To permit accessibility and yet allow



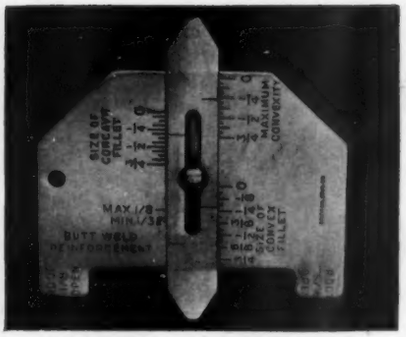
physical separation from the power circuit, all auxiliary control is mounted inside the Weld-O-Trol steel cabinet door. Ample space is provided for power and control leads. The unit is adaptable for heat control and either synchronous or non-synchronous weld timers, and sequencing equipment.

Dayton Rogers Die Cushions Have 90-Ton Holding Pressure

The Model 2C pneumatic die cushion manufactured by the Dayton Rogers Mfg. Co., 2830—13th Ave. South, Minneapolis, Minn., is self-contained, carries its own surge tanks, and is now made in sizes up to and including 24 in. The new heavy-duty die cushion can be furnished in multiples of 2, 4 or 6, having maximum ring holding pressure up to and including 90 tons, with drawing capacity for deep drawing shells up to and including 10 in.

These cushions can be used for controlling the pressure pads. Each cushion installation is supplied with a combination regulating reducing valve and pressure gage to retain the correct draw ring holding pressure and pressure pad control throughout the work cycle, on a given job. The working pressure is recorded at all times on the gage furnished with each installation.

This cushion is claimed to be particularly suitable for large straight side presses, in the drawing and forming of such parts as table tops, stove tops, refrigerator sections, and automobile body doors.

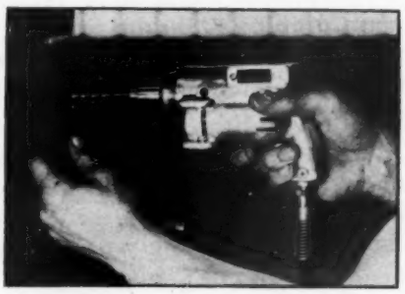


Chicago Tool Offers Gage For Checking Weld Fillets

Making it possible to accurately calibrate butt and fillet type welds, the Chicago Tool & Engineering Co., 8389 So. Chicago Ave., Chicago, Ill., has developed a new welding gage. A simple adjustment gives accurate reading to determine size of convex fillet welds. To check permissible tolerances of convexity, readings are taken at the specified angle. With a similar application of the instrument, the welder can determine the exact size of concave fillet welds. Butt weld reinforcements can also be checked with high accuracy. The instrument is known as the Palmgren welding gage, and is of convenient pocket size.

Pistol Grip 1/4-in. Drill Developed by Mall Tool

A new pistol grip ¼-in. drill announced by the Mall Tool Co., 7740 So. Chicago Ave., Chicago, Ill., is claimed to be ideal for getting into close quarters and is recommended for airplane and auto body building, sheet metal work and other applications where



high speed production drills are required. Castings are aluminum for high strength and light weight. All high speed bearings nest in steel inserts which are cast integral with castings. The armature is balanced to insure smooth operation and long life. Gears are made of heat-treated special alloy steel, and an improved fan gives more efficient cooling. The handle is cooled by a stream of air flowing through it.

The capacity in steel is ¼ in. The no-load speed is 2,200 r.p.m. and the full load speed 1,800 r.p.m. Net weight, with cord, is 4 lb.

Machines you should know about

BROACHING PAYS IN JOB LOTS

Number 4

The

"JUNIOR"

ON THE JUNIOR—a low cost bench press all-hydraulic in operation—you can perform all kinds of miscellaneous operations—broaching, assembly, light straightening, etc.—in job lots or continuously.

It is the sort of machine that is spelling the difference between a headache and a profit on numerous fussy little jobs.

For the money involved you can't go wrong—and you don't have to wait 18 months to get one (or a dozen) either.

We will be glad to send you a specifications sheet and prices. *Just drop us a line.*

The

"SENIOR"

WHERE YOU WANT to cut production costs—or if you just don't want to wait 12 to 18 months for milling machines—this Senior Press by Colonial will do many a "milling," "boring," or "reaming" job faster, cheaper and more accurately—by broaching.

It is the kind of machine that—when the present furore is over—you will be glad to have in your shop; to make profits when the going is tougher.

We'll be glad to tell you how many of your present or proposed jobs can be handled on this machine. Send us blueprints or ask us to have a field engineer stop in.

If you just want specifications, now, ask for Bulletin No. VBS-40.

COLONIAL BROACH COMPANY

147 Jos. Campau Street **Detroit, U. S. A.**

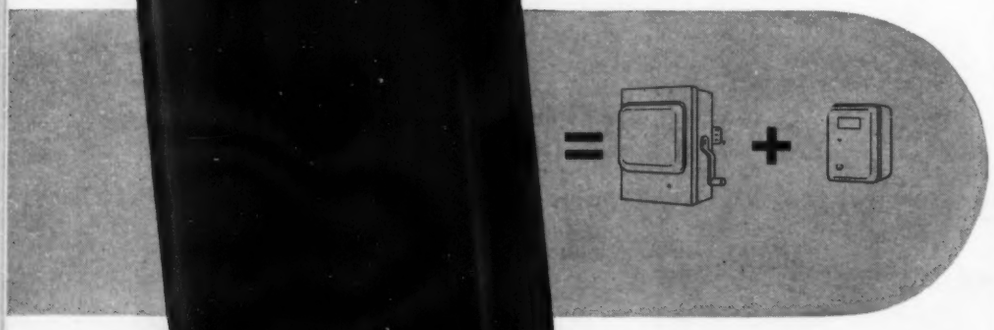
WANT TO EXPEDITE TOOLING UP? COMBINATION STARTERS WILL HELP YOU GET GOING SOONER

You can save *hours* on every a-c motor-control you install by using G-E full-voltage combination starters instead of separate devices. That means *getting vital production rolling sooner.*

ONE machine that can do the job of two can save you *time*, *money*, and valuable *space*. The same is true of this modern motor control.

IT'S SAFER TOO

By combining the manual circuit switch and magnetic starter in a single safety-interlocked enclosure, extra protection is provided—an important advantage where inexperienced workers operate or maintain the equipment. It is impossible to get at live parts of this starter as long as the line switch is closed—and while the cover remains open, the circuit switch cannot be closed to energize exposed parts.



GENERAL ELECTRIC

NEW MATERIALS

Alrose Immersion Tin Finish Is for Copper and Brass

The Alrose Chemical Co. of Providence, R. I., announces Bon White, a new immersion tin finish applicable to all copper and brass surfaces. Bon White can be applied in ten seconds and can, in many instances, replace slow boiling methods of tin plating. The solution is prepared by dissolving 16 oz. of sodium cyanide and 6 oz. of Bon White paste in 1 gal. of boiling water. When cooled to room temperature, no further heat is necessary and no adjustment is required, as the material is completely plated from the solution. The life of the solution depends on the production volume.

Enamel and glass containers are used and the work can be handled in baskets or on wire. Bon White assures a highly-effective white finish and, being pure tin, offers considerable tarnish resistance.

U. S. Rubber Develops Cellular Rubber for Insulation

A new material of high insulation value that is twice as light as cork, is announced by United States Rubber Co., 1230—6th Ave., New York, N. Y. Known as cellular rubber, the material consists of a thin external dense layer inclosing microscopic cells of nitrogen gas in a matrix of rubber. The "K" insulation value (b.t.u. per hr. per deg. F. temperature difference for a specimen 1 ft. square and 1 in. thick) of cellular rubber is expressed as 0.237. This figure compares with 0.30 for regranulated cork, 0.34 for gypsum in powdered form, 0.39 for laminated fibre board, and 0.59 for cellular gypsum dry.

Other specific properties claimed for the new rubber are: moisture resistance, rot proof, oil, acid and fire resistant, structural strength, long life, resistance to vermin and termites, and good workability. Two weights of the U. S. Royal insulation board are to be manufactured: 4.5 lb. per cu.ft. and 5.5 lb. per cu.ft. for 1-in. thick material. Unusual structural strength is combined with this lightness. The boards can easily be cut to shape with a bandsaw or powersaw, and surfacing can be done with a planer. The material is thermoplastic.

McKenna Metals Announces Improved Grades of Kennametal

Greater hardness and strength than previously is offered by McKenna Metals Co., 103 Lloyd Ave., Latrobe, Pa., in their various grades of Kennametal steel-cutting tool carbides. The new hardness and strength values for the four standard grades of Kennametal are as follows:

Grade KM—Rockwell C, 77.6; Rock-

well A, 90.8; strength trans. rupture, 350,000 lb. per sq.in.

Grade KH—Rockwell C, 78.6; Rockwell A, 91.3; strength trans. rupture, 275,000 lb. per sq.in.

Grade K3H—Rockwell C, 79.6; Rockwell A, 81.8; strength trans. rupture, 260,000 lb. per sq.in.

Grade K4H—Rockwell C, 80.6; Rockwell A. 92.3; strength trans. rupture, 225,000 lb. per sq.in.

Grade KM is used on 90 per cent of steel cutting jobs, in lathe and boring tools for machining alloy steel and carbon steel forgings, castings, and bar stock. It is exceptionally strong, enabling it to be used for shaping hard armor plate as well as for turning and facing over interruptions.

Kennametal grades KH and K3H are used on light finishing cuts or where the steel being cut is very soft. Grade K4H is extremely hard and is used for precision boring of steel with light cuts.

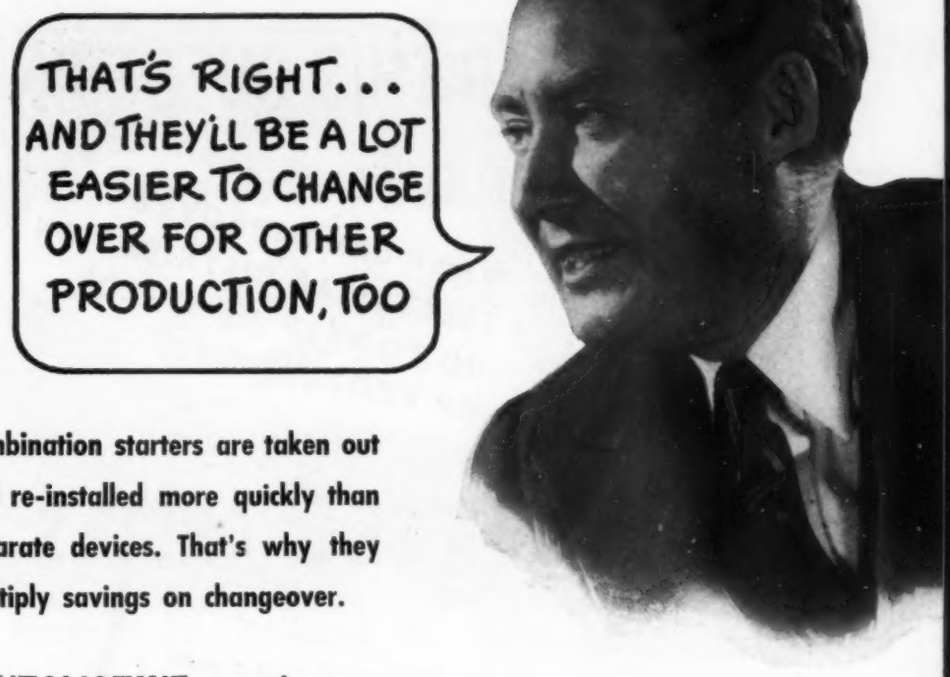
TRADE PUBLICATIONS

AIR COMPRESSORS An air compressor selector is being currently furnished by the Quincy Compressor Co., Quincy, Ill. It is designed to aid in selecting the correct size and type of compressor for a specific job. It functions like a slide rule. One setting of the scale shows correct compressor model number, free air delivery, r.p.m., piston displacement and motor horsepower requirement. The selector also contains figures for making allowances for loss in free air delivery at high altitudes. Pressures covered by the selector range from 30 to 250 lb.

BALL BEARINGS New Departure, Div. of General Motors Corp., Bristol, Conn., has just issued the 15th edition of their handbook, listing the principal types and sizes of forged steel ball bearings. This book has a new finger index for quick reference and in addition to dimensions, capacities, tolerances and mounting fits, contains new data to simplify selection of bearings for loads and length of service.

CHAIN SLINGS S. G. Taylor Chain Co., Hammond, Ind., is circulating its bulletin No. 12 which gives safe working loads at various sling angles for Taylor-Mesaba iron sling chains. Specifications are given for these slings, including length of chain, size of eyes, size of hooks, and weight of slings. Also included are definitions, cautions and instructions governing the purchase and use of chains.

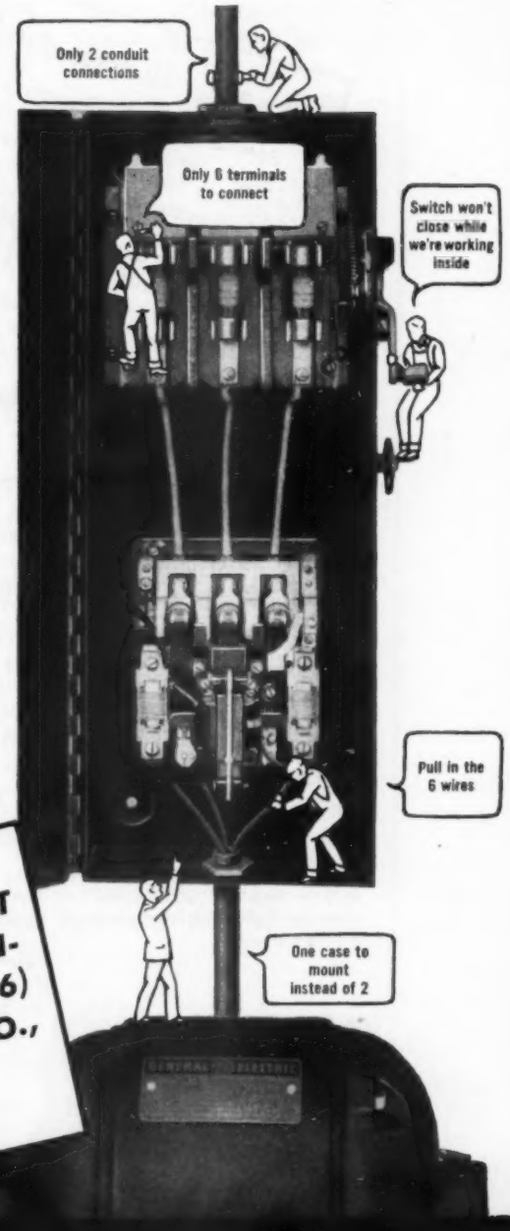
COLLETS Up-to-date information on collets for different makes of lathes and milling machines is given in a recent bulletin No. 41 published by Hardinge Bros., Inc., Elmira, N. Y. The proper name for each type of collet, the maximum round, square and hex-



Combination starters are taken out and re-installed more quickly than separate devices. That's why they multiply savings on changeover.

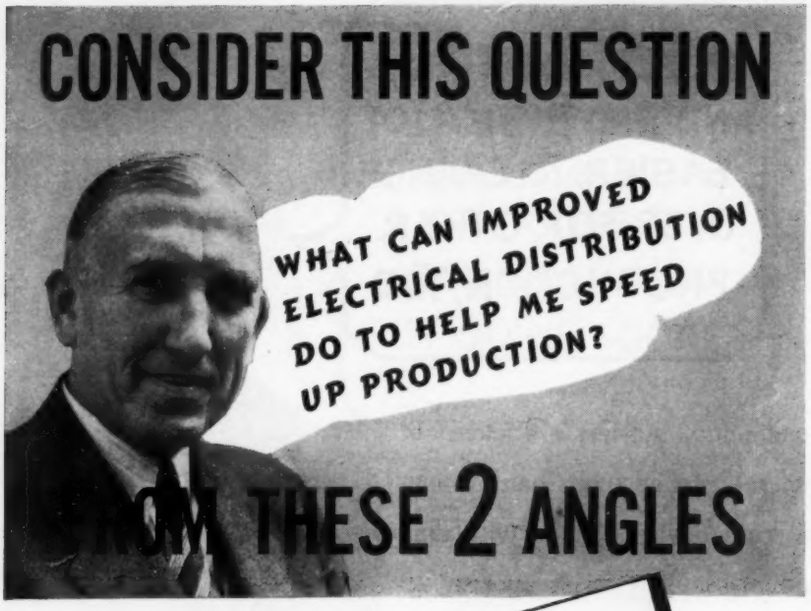
AUTOMOTIVE manufacturers have long recognized that the right control for them is the control that has everything in one "package." That's because, with mass-production methods, they periodically change over their equipment to re-adapt it to changing demands. It's especially during this changeover period that savings are made—you make the original installation savings all over again each time the motor, or control, or machine is relocated.

Do as the leading automotive manufacturers do—use G-E combination starters for your new plant equipment. Your G-E agent or the nearest G-E office can give you full information.


Only 2 conduit connections
Only 6 terminals to connect
Switch won't close while we're working inside
Pull in the 6 wires
One case to mount instead of 2

SEND FOR "HOW TO GET MORE FOR YOUR CONTROL DOLLAR" (GES2456) GENERAL ELECTRIC CO., SCHENECTADY, N. Y.

GENERAL ELECTRIC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WHAT CAN IMPROVED ELECTRICAL DISTRIBUTION DO TO HELP ME SPEED UP PRODUCTION?
FROM THESE 2 ANGLES

1. Better electrical distribution IN the plant

Special *Bus-Duct** systems of plant wiring give a highly flexible power-supply service, easily installed, quickly adapted to changes in plant layout. Trol-E-Duct systems for portable tools and lighting units are ideal along production lines.

Other important advances in conduit, fittings, panelboards, wiring devices give a plant that's wired to *modern* standards a definite advantage in production efficiency as a result of fewer power interruptions, quicker change-overs, with all the "juice" you need quickly available at any point.

2. Better electrical distribution TO the plant

When you or your electrical contractor want the best in wiring supplies for industrial plants *in a hurry*, that's when you'll appreciate GRAYBAR distribution service. One call to your local GRAYBAR house will get you everything that's needed: wire, conduit, fittings, panelboards, circuit breakers, switches, etc., each the product of a leading manufacturer. What's more, every item, from tape to transformers, is backed by the satisfaction-insurance of the GRAYBAR Tag.

***Write today for Bulletin 403 describing the Modern Bulldog "BUStribution" System and showing typical installation views in metal-working plants.**

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agonal capacities, the major dimensions for identification purposes, and prices are presented. Details are also given on how the modern Sjogren speed collet chuck can be adapted to lathes and milling machines, together with features gained by such application.

DUST COLLECTORS The Schneible Midget multi-wash dust and fume collector is described in Bulletin No. 239 just published by Claude B. Schneible Co., 3951 Lawrence Ave., Chicago, Ill. General dimensions, capacity and horsepower requirements for these collectors are given.

MARINE ELECTRIC COUPLINGS Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is circulating a new six-page folder, No. F-8635, which illustrates, describes, discusses advantages and construction features of electric couplings for transmitting engine torque to the gear in diesel power vessels between 500 and 5,000 hp.

METALLIZING The Metallizing Company of America, Inc., has published a pamphlet describing metallizing equipment, preparation of the part to be metallized, weights of different metals required for the process, and estimated costs. A major portion of the pamphlet is devoted to a detailed description of specific metallized jobs in various industrial fields.

MELTING POTS Specifications and prices for soldering, melting, and glue pots are contained in a recent catalog circulated by Russell Electric Co., 340 W. Huron St., Chicago, Ill.

OPPORTUNITY Farrel - Birmingham Co., Inc., Ansonia, Conn., is circulating Booklet No. 40, "What Will Peace Bring?" The booklet, which is the latest of the company's series of booklet editorials, attempts to answer the following questions: "What problems and opportunities will the end of the second world war bring to the U. S.? How will we be effected economically?"

REBUILT MACHINES J. L. Lucas & Son, Inc., Bridgeport, Conn., has just published its Bulletin No. 107-S listing completely rebuilt machines ready for sale. This illustrated bulletin includes boring mills, drill presses, cylindrical grinders, lathes, milling machines, planers, automatic screw machines, slotters, tappers, turret lathes and presses.

TACHOMETERS Boulin Instrument Corp., 65 Madison Ave., New York, N. Y., have just published a four-page folder which describes, illustrates and provides specifications of centrifugal tachometers. The description includes single range hand and stationary tachometers.

TIME-CYCLE CONTROLLERS Detailed information on time-cycle controllers for tire presses, plastic molds,

general-purpose operations, and coordinated process control is given in Catalog No. 572 just published by the Bristol Co., Waterbury, Conn. It is liberally illustrated with line drawings to show principles of operation and use of the controllers on a variety of plant processes.

TUBE BENDING MACHINES The Parker Appliance Co., 17325 Euclid Ave., Cleveland, Ohio, is circulating a four-page folder which describes the construction and operation of the Parkermatic bending machine.

V-DRIVES The B. F. Goodrich Co., Akron, Ohio, is featuring a one-page catalog section on standard fractional horsepower, V-belts. The section describes the balanced construction of the V-belt and the advantages of V-drives.

WELDING CONTROL Westinghouse Electric & Mfg. Co. is circulating a 4-page catalog No. 26-210 which illustrates and describes welding circuit control panels with basic ratings up to 300 amp. for constant potential multiple operator welding systems.

NEW BOOKS

AUTOMATIC SCREW MACHINES—*Series of fourteen booklets to aid beginners in screw machine operation. Published by Brown & Sharpe Mfg. Company, Providence, R. I. 50 cents per set.*

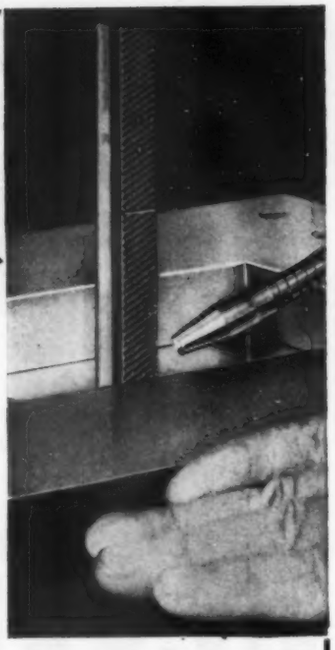
This series of 14 booklets has been written to help in training operators of single-spindle automatic screw machines. It was prepared on the assumption that the reader has never before operated a screw machine, and that he may not have had any previous experience with machine tools. It is the practice in most shops to start a new man under the guidance of an experienced operator, permitting him to advance to more and more difficult jobs as he gains knowledge of screw machine practice. These booklets follow this old shop method of training.

The first booklet of the series gives a general explanation of how Brown & Sharpe screw machines operate, and names most of the important parts or units. Then, in the next twelve booklets of the series twelve typical screw machine jobs are covered, one to a booklet. In each of these twelve booklets each step in the set-up and operation is described in exact detail, in the expectation that a new man who carefully follows the sequence of moves and adjustments could, under the guidance of an experienced operator, produce the piece described or one similar to it. At the same time, each booklet gives many of the reasons "why" and explains the purpose behind each important adjustment. Finally, in booklet No. 14, the principal attachments used on Brown & Sharpe automatic screw machines are

DoAll BAND FILES

Get Hard Jobs Done

FASTER BETTER SMOOTHER



Yes Sir—actual performance records prove that these modern files are 8 times as fast as hand filing—5 times as fast as jig filing. And today, time is all important.

Each file segment is automatically locked into one rigid, continuous file before it reaches point of work.

STOP FILE BOTTLENECKS

SEE HOW DoAll File Bands WORK

Don't let slow filing methods tie up your production. With DoAll Band Files you can do *difficult internal or external filing*—finish special tools, molds and dies for your own plant use in 1/5th to 1/8th the time it takes to jig file or hand file them. Also, you can complete orders in record time.

WIDE RANGE OF SIZES AND STYLES

DoAll Band Files come in 3 widths, 23 styles, cuts and sizes—Files to cut everything from hardest high carbon steel to brass and plastics.

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THE DOALL COMPANY, INC.

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Associated with Continental Machines, Inc., Minneapolis, Minn.

Here is a single, flexible, precision grinding machine so versatile that it will handle external, internal, surface, tool spur gear and other classes of grinding. Shifts from job to job easily and quickly. A real convenience and money saver for maintenance shops and tool rooms. Conserve time, floorspace and money on small lot work with a single machine that performs every operation required of an entire grinding department in many plants. Large new folder, profusely illustrated, gives all details. Free to executives requesting it on business letterhead. Write for your copy today.

FITCHBURG
GRINDING MACHINE CORP.
1708 FALULAH RD., FITCHBURG, MASS.
U.S.A.

described. Also included in this last booklet are a number of useful tables with which the operator of a single-spindle screw machine should be familiar.

Being in booklet form, the series is readily adapted to lecture or school use, and to encourage this method of training Brown & Sharpe is offering a "teaching kit" with orders for twelve or more sets of booklets. This kit consists of complete machine and attachment specifications, a copy of the book "Construction and Use of Automatic Screw Machines" which regularly sells for $1.00 per copy, a booklet on screw machine tools, and a general catalog listing B. & S. screw machine equipment.

As the field covered includes adjustment and set-up for a variety of jobs, the booklets should be of considerable value to the more experienced operator, as well as for the novice for whom they are primarily intended. Each set of 14 booklets is packaged in a substantial indexed envelope.

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FACTORY INSTALLATION WORK—*By A. J. Coker. 240 pages. Published by Chemical Publishing Company, 148 Lafayette St., New York, N. Y. $2.50.*

The author presents information on electrical installations in small shops and factories. Factory sub-stations, distribution switchgear and cables, motor control gear, and lighting and heating distributions circuits are the main subjects. Related subjects, such as power-factor correction equipment, as well as earthing and protective devices, are also included. Throughout the book, due attention has been paid to Home Office Regulations as stipulated in the Factory and Work Shop Act.

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TRAINING WORKERS AND SUPERVISORS—*By Charles Reitell. 182 pages. Published by The Ronald Press Company, 15 East 62 St., New York, N. Y. $1.50.*

There is little danger of overstressing the dire need for skilled workers in our defense industries. Accordingly, whenever a book comes along which can help in the training of men, it should be analyzed carefully.

Reitell's book has been planned in four parts. Part I discusses principles and methods for selecting new employees. Job ratings, the use of application forms and procedures, the place of tests, and the techniques of interviewing are specifically treated. Part II offers specific methods of training. It advises how to take advantage of the two roads to training success—the building of correct habits in performance of operations and the tested techniques of good teaching. This part is directed toward the training of trainers of the trainees.

Part III is concerned with the training that builds good standard performance. The role of standards and their specific application to costs, to quality and quantity, and to planned operations is discussed in detail. Part IV presents the underlying factors in the relationship of management and labor whose basic importance must be recognized and faced.

In general the book is a rather comprehensive analysis of the problems met. In evaluating the answers provided, however, the fact that industrial thinking changes from time to time must be taken into account. Reitell realizes this and writes accordingly.

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INTRODUCTION TO WORKS PRACTICE—*Edited by E. Molloy, Electrical Engineer. Printed in Great Britain. 104 pages. Chemical Publishing Company, 234 King St., Brooklyn, N. Y. $2.00.*

Prepared especially for the apprentice machinist and the student of production engineering, this elementary handbook is divided into four sections. In the first section the student is given a bird's-eye view of production engineering principles, and of the problems involved in manufacturing a number of types of products.

In the section chapter are discussed the principles of blueprint reading, while the principles involved in reading the micrometer and the vernier caliper are discussed in the third chapter. In the fourth and final chapter the authors discuss workshop calculations and formulae in simple, easy to understand terms.

Like so many other books written for the beginner, this volume attempts to cover the many facets of machine shop work without going into much detail in explaining the principles of any group of operations. While the book does contain a considerable amount of usable information, it should not be considered a complete treatise on machine shop work.

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A B C AVIATION—*By Lt. Col. Victor W. Page, Air Corps Reserve, U.S.A. 598 pages. Published by the Norman W. Henley Publishing Company, 17-19 West 45 St., New York, N. Y. $2.50.*

An elementary introduction to the study of aviation, this book has been enlarged and revised since its publication in 1939. Containing 285 drawings and photographs the volume could be used as a non-technical text in aircraft instruction classes. In the main it is an exposition of all types of aircraft with authentic instruction on their basic principles of construction and operation. Important recent airplanes are described, as are diesel and gasoline engines, airliners, and plastic planes. The procedure for inspection and trouble shooting prior to flight is outlined in detail; the same can be said for instruments which are used for blind flying. Indicating a systematic thoroughness, the author has

included an analysis of ordinary and acrobatic flight maneuvers, the various radio aids and beacons.

Throughout the book one gets the impression that a great deal of ground has been covered. For example, in a chapter on construction the material presented covers such subjects as: all parts, reduction of air resistance, wing curve, specifications, lift, landing gear and loading. In a chapter on airplane structures and design, the discussion embraces: metal structures, power requirements, and weight estimations; the chapter concludes with comments on the latest developments. Finally, the book tells the story of aircraft from the very beginning of the industry.

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FINANCING DEFENSE ORDERS—*By Lynn L. Bollinger, Harvard Graduate School of Business Administration. 172 pages. Published by the McGraw-Hill Company, 330 West 42 St., New York, N. Y. $2.50.*

Dealing specifically with the problems encountered by a defense manufacturer in need of working capital, this book indicates that, for the most part, ordinary commercial banks have been satisfactory in the majority of cases. Because many holders of defense contracts cannot secure commercial bank loans for one reason or another, or do not find it convenient to do so, other financing methods have been utilized. Included are: assignable contracts, warehousing, trust receipts, chattel mortgages, insurance on the life of the company's chief executive, agreements to subordinate creditor claims and Federal Reserve Bank participation. These methods are outlined in order. Because the utility of each varies with the circumstances, they are described in a background of actual cases.

The workings of the Defense Contract Service, and the Federal Loan Agencies' subsidiaries, the Reconstruction Finance Corporation and the Defense Plant Corporation, are described in detail. The book comments on the government financial advance to contractors and how this may be used in further financing. It is indeed a valuable aid to manufacturers who are encountered with the problem of securing more working capital. Those who have this information will be able to avoid many pitfalls.

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INDUSTRY GOES TO WAR—*By C. E. Fraser and S. T. Teele. 123 pages. Published by McGraw-Hill Book Company, 330 W. 42 St., New York. $1.50.*

Industrial mobilization for war is a complex subject which, if not handled right in a time of emergency, may in itself spell defeat. If efficiently carried out, on the other hand, it may well be the biggest factor in achieving a military victory. It is a subject which has been given earnest and intensive

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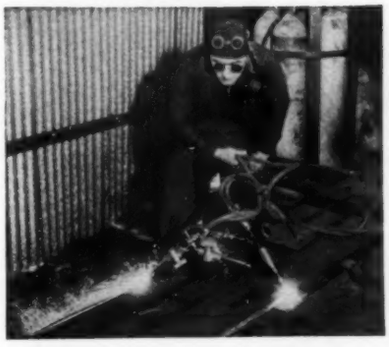

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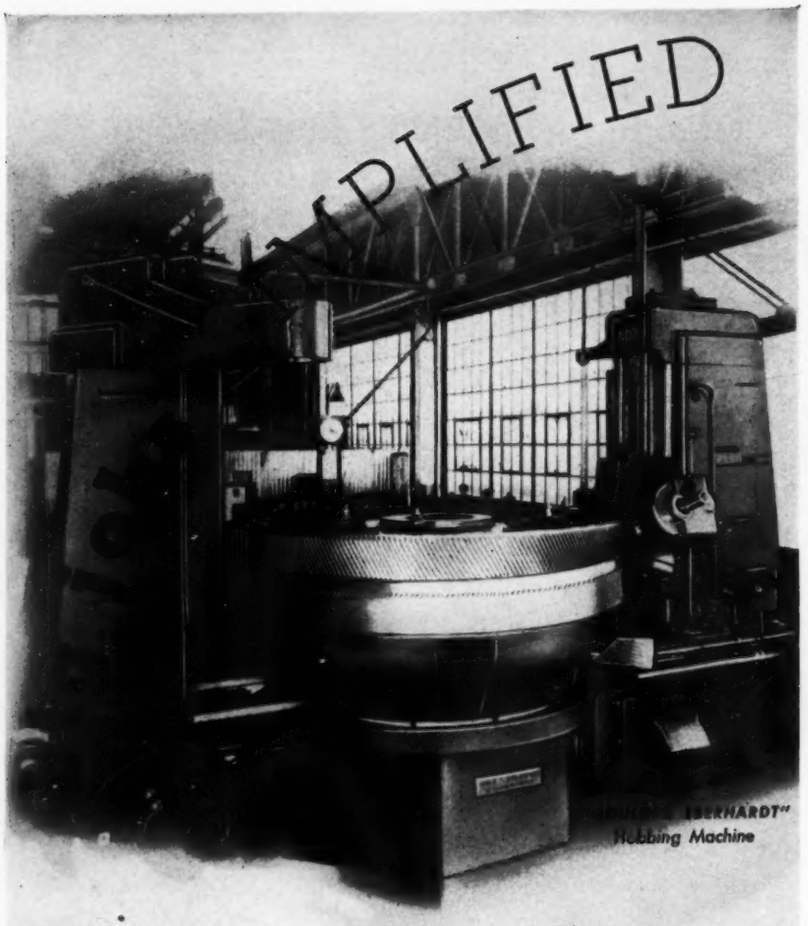

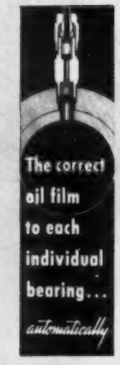

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study in this country for years, particularly by the Harvard Business School in cooperation with the Army Industrial College.

Beginning in 1940 the Harvard Business School has given courses in industrial mobilization and in economics of national defense. In preparing these courses, faculty members have done research work which has resulted in publication of a number of articles in important magazines. Some of these articles, together with selected articles by other writers, have been put together in a single volume, "Industry Goes To War." All the articles included were originally printed in the *Harvard Business Review*.

The articles cover a wide range of subjects: guns and butter, war-time labor productivity, defense "lending," food in wartime, minerals and war, priorities, mobilizing industry for war, negotiated contracts, buying Latin-American loyalty. The book is admirably designed for the student or the person interested in securing authoritative data on industry's part in war.

A word about the physical make-up of the book: it is larger than normal size, the binding is particularly attractive and rugged, and type is big enough to be easy on the eyes. For anyone concerned with industrial mobilization for war, this is a "must" book.

TO THE EDITOR

Remedy for Labor Shortage

Dear Sir:

The recent discovery of the shortage of skilled labor, especially all-round machinists, tool- and diemakers, is attributable in part to the negligence of manufacturers and shop owners. During the past 20 years they have slighted the old fashioned apprenticeship system, the main source of thoroughly trained mechanics.

Another reason for the shortage is the present educational facilities which are within reach of the lower economic groups. Thus the children of even the poorest classes in many cases reach for white collar jobs. Perhaps too many of our young men aspire to such positions.

Union groups have had a hand in the shortage. The old apprenticeship laws, formulated by the unions as part of their by-laws, stipulate that only one apprentice be allowed for each shop and that only one apprentice be allowed for each five additional five journeymen employed. These agreements should have been relaxed.

Hours and wages in skilled crafts should be scaled so that they compare favorably with business and other jobs. Only by this method can enough men be attracted to learn a skilled trade. I suggest that shop owners and manufacturers cooperate to perpetuate and encourage the growth of all crafts.

Yours very truly,

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